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# War Needs Is Theme at Power Exposition

## Exhibits Illustrate Hundreds of New Solutions For Wartime Problems Arising in Thousands of Manufacturing Plants—Many Products on Display Are of Special Interest to Paper Industry.

The Fifteenth National Exposition of Power and Mechanical Engineering opened at Madison Square Garden, New York, on November 30 and will be continued to December 4. The show was held in the exposition hall of the Garden, which has the advantage that it permits all exhibits to be arranged on one floor. A special entrance through a new lobby on 49th street providing separate and direct access to the show.

The exposition this year was organized for the special purpose of contributing to the Nation's war effort by concentrating at one time and place, information and the mental resources needed to maintain and increase power production and to utilize it more efficiently. Among these innovations was the pneumatic spreader principle of design in stokers, exhaust snubbers for silencing engine exhausts, extensive lines of insulating materials, pipes and fittings, control by photo-cells, a great variety in transmissions recording and metering equipment, filtering, lubricating, material handling equipment and a wide range of small tools.

The products of particular interest to the paper and pulp industry and well known through installation in numerous mills are briefly summarized in the following exhibits of individual concerns:

### Cambridge Instrument Co.

The Cambridge Instrument Company, featured a new industrial analyzer for continuously determining and recording CO plus $H_2$ in various atmospheres; also other instruments such as pH equipment for plant and laboratory, $O_2$ Recorder, Dissolved $O_2$ Recorder, $CO_2$ Recorder, Surface, Mold and Needle Pyrometers, Fluxmeter, Fabric Permeameter, Aero-Mixture Indicator and a new portable Exhaust Gas Tester.

The following engineers were in attendance: Messrs. Paully, Watkins, Campbell, Matthieson, Deemer, Fleming, Young, Wood, Fawcett, Worstall, Richardson, and Jefferson.

### Dodge Mfg. Corp.

The Dodge Manufacturing Corporation featured a new wooden V-Belt Pulley, made of laminated maple, to take the place of critical metals. Dodge-Timken bearings were also on display.

Representatives in attendance included Frank T. O'Hara, F. A. Brede, C. W. Brett, and D. M. Johnson.

### Garlock Packing Co.

The exhibit of the Garlock Packing Company featured the new Garlock Lattice-Braid Packings, new and different from other braid packings, with each strand diagonally braided. It is of particular value in applications requiring maximum porosity with high pressures. The company's 730 Lattice-Braid Coil and Garlock Rings were also among the products shown.

Representatives in attendance were F. P. Morton and John Reyelt.

### Gulf Oil Corp.

The display of the Gulf Oil Corporation featured the concern's Gulfcrest steam turbine oil. This oil was perfected to meet the high temperatures, high rotating speeds, and the constant mixing of air in the oil which exert a deteriorating influence on lubricating oils.

The corporation was represented by B. F. Hunter, Dr. L. W. Volmer and G. L. Benjamin.

### Johns-Manville Corp.

The exhibit of Johns-Manville featured Transite pipe for stock line installation, made of asbestos and cement and highly resistant to all forms of corrosion. Corrugated Transite for siding and roofs of mills was also shown. Many other types of insulating materials for various types of boilers, digesters, steam lines, flat transite for machine hoods, friction materials for drying rolls and special packings for calender stacks and other equipment were exhibited.

*(Continued on page 14)*

# Printing Committee Lets Paper Contracts

## Joint Congressional Printing Committee Makes Awards For Supplying U. S. Government Printing Office With 150,000,000 Pounds Of Paper For The Six Months Period Beginning January 1, 1942.

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., November 30, 1942—The Joint Congressional Committee on Printing today made awards on more than 150,000,000 pounds of paper for the use of the Government Printing Office for the six months period beginning January 1. Bids for this paper were opened on November 23. The awards were as follows:

No. 1. Marquette Paper Corp., 2.50 cents (3,600,000 pounds; Great Northern Paper Co., 2.50 cents (1,400,000 pounds).

No. 2. Walker-Goulard-Plehn Co. Inc., 4.35 cents (500,000 pounds); 4.45 cents (1,000,000 pounds).

No. 3. Butler Co. 6.47 cents (200,000 pounds); Marquette Paper Corp., 6.54 (balance).

No. 4. Marquette Paper Corp., 6.44 cents.

No. 5. Marquette Paper Corp., 6.44 cents.

No. 6. Marquette Paper Corp., 5.82 cents.

No. 7. Central Ohio Paper Co., 5.82 cents.

No. 8. Central Ohio Paper Co., 5.82 cents.

No. 9. Central Ohio Paper Co., 5.82 cents.

No. 10. Central Ohio Paper Co., 5.93 cents.

No. 18. Central Ohio Paper Co., 6.64 cents.

No. 19. Bermingham & Prosser Co., 7.23 cents (200,000 pounds); Marquette Paper Co., 7.34 cents (2,500,000 pounds); 7.46 cents (600,000 pounds); Butler Co., 7.23 cents (200,000 pounds); Central Ohio Paper Co., 6.92 cents (500,000 pounds).

No. 20. Aetna Paper Co., 6.87 cents.

No. 21. R. P. Andrews Paper Co., 7.07 cents (1,000,000 pounds); Bulkley-Dunton & Co., 6.68 cents (400,000 pounds); 6.93 cents (400,000 pounds); Marquette Paper Co., 7.09 cents (700,000 pounds); 7.54 cents (500,000 pounds).

No. 22. D. L. Ward Co., 6.25 cents.

No. 23. Marquette Paper Co., 7.42 cents.

No. 24. Paper Corp. of U.S. 14.97 cents.

No. 26. Aetna Paper Co., 10.97 cents.

No. 27. Aetna Paper Co., 10.97 cents.

No. 29. Aetna Paper Co., 14.73 cents.

No. 33. Marquette Paper Corp., 6.33 cents.

No. 34. Marquette Paper Corp., 6.21 cents.

No. 35. Graham Paper Co., 5.98 cents.

No. 37. Barton, Duer & Koch Paper Co., 6.05 cents.

No. 38. Barton, Duer & Koch Paper Co., 5.00 cents.

No. 39. Barton, Duer & Koch Paper Co., 5.85 cents.

No. 40. Barton, Duer & Koch Paper Co., 4.65 cents.

No. 41. Kennelly Paper Co. Inc., 6.75 cents (starch sized).

No. 43. Walker-Goulard-Plehn Co. Inc., 11.35 cents.

No. 44. Marquette Paper Co., 4.73 cents; Old Dominion Paper Co., 4.6238 cents.

No. 45. Walker-Goulard-Plehn Co. Inc., 6.01 cents.

No. 46. Bulkley, Dunton & Co., 6.51 cents.

No. 48. Aetna Paper Co., 7.97 cents.

No. 51. D. L. Ward Co., 11.91 cents (300,000 pounds); R. P. Andrews Paper Co., 11.93 cents (300,000 pounds).

No. 52. R. P. Andrews Paper Co., 11.50 cents (white) 12.00 cents (blue).

No. 55. Whitaker Paper Co., 6.77 cents (3,000,000 pounds); Barton, Duer & Koch Paper Co., 6.93 cents (1,000,000 pounds); Eastern Corp., 6.97 cents (100,000 pounds); R. P. Andrews Paper Co., 6.87 cents (1,000,000 pounds); Perkins-Goodwin Co., 6.84 cents (400,000 pounds), Central Ohio Paper Co., 6.91 cents (500,000 pounds); Parsons Paper Co., 6.951 cents (1,000,000 pounds).

No. 56. Whitaker Paper Co., 6.77 cents (4,000,000 pounds); Mudge Paper Co., 6.25 cents (1,000,000 pounds); D. L. Ward Co., 6.86 cents (1,000,000 pounds); 6.93 cents (200,000 pounds); Resolute Paper Products Corp., 6.2344 cents (1,000,000 pounds); Boston Paperboard Co., 6.80 cents (800,000 pounds); Barton, Duer & Koch Paper Co., 6.83 cents (1,000,000 pounds) R. P. Andrews Paper Co., 6.74 cents (4,000,000 pounds); Bulkley, Dunton, and Co., 6.81 cents (1,000,000 pounds); Perkins-Goodwin Co., 6.84 cents (1,000,000 pounds).

No. 58. D. L. Ward Co., 6.39 cents (1,350,000 pounds); Stanford Paper Co., 6.39 cents (1,350,000 pounds); Butler Co., 6.13 cents (1,000,000 pounds); Perkins-Goodwin Co., 6.39 cents (300,000 pounds).

No. 59. Cauthorne Paper Co., 6.39 cents (500,000 pounds); D. L. Ward Co., 6.39 cents (500,000 pounds); Walker-Goulard-Plehn, 5.95 cents (400,000 pounds); Chatfield & Woods Co., of P. A., 5.98 cents (100,000 pounds); Stanford Paper Co., 6.39 cents (300,000 pounds); Perkins-Goodwins Co., 6.19 cents (200,000 pounds).

No. 61. Mudge Paper Co., 7.00 cents (1,000,000 pounds); D. L. Ward Co., 7.24 cents (200,000 pounds); 7.39 cents (100,000 pounds); Old Dominion Paper Co., 7.1638 cents (700,000 pounds); Walker-Goulard-Plehn Co., 7.25 cents (200,000 pounds); Barton, Duer & Koch Paper Co., 7.25 cents (300,000 pounds); Aetna Paper Co., 7.23 cents (500,000 pounds).

No. 62. Walker-Goulard-Plehn Co. Inc., 6.74 cents.

No. 64. Whitaker Paper Co., 7.77 cents.

No. 65. Stanford Paper Co., 12.44 cents.

No. 66. Mudge Paper Co., 14.28 cents.

No. 67. Mudge Paper Co., 14.58.

No. 68. Paper Corp of U.S., 17.96 cents.

No. 69. Paper Corp of U. S., 17.96 cents.

No. 70. Paper Corp of U. S., 17.96 cents.

No. 71. Paper Corp of U. S., 7.83 cents (500,000 pounds); Graham Paper Co., 7.95 cents (500,000 pounds).

No. 72. Graham Paper Co., 7.45 cents.

No. 73. Paper Corp of U. S., 8.53 cents (200,000 pounds); 8.65 cents (200,000 pounds).

No. 75. Marquette Paper Co., 12.75 cents (150,000 pounds); 21.75 cents (150,000 pounds).

No. 76. Old Dominion Paper Co., 16.953 cents

(50,000 pounds); 17.734 cents (100,000 pounds); Walker-Goulard-Plehn Co., 18.30 cents (300,000 pounds); Barton, Duer & Koch Paper Co., 18.00 cents (200,000 pounds); Stanford Paper Co., 18.33 cents (150,000 pounds).

No. 77. Walker-Goulard-Plehn Co., 17.80 cents.

No. 78. Old Dominion Paper Co., 17.984 cents (100,000 pounds); 18.479 cents (100,000 pounds); Bermingham & Prosser Co., 19.36 cents (200,000 pounds).

No. 84. Barton, Duer & Koch Paper Co., 25.75 cents.

No. 85. Barton, Duer & Koch Paper Co., 19.35 cents (200,000 pounds); R. P. Andrews Paper Co., 20.34 cents (200,000 pounds).

No. 101. Barton, Duer & Koch Paper Co., 7.96 cents.

No. 102. D. L. Ward Co., 6.93 cents (1,000,000 pounds); Eastern Corp., 6.97 cents (1,000,000 pounds).

No. 103. Eastern Corp., 7.72 cents.

No. 105. Aetna Paper Co., 13.22 cents.

No. 106. Whitaker Paper Co., 11.98 cents (400,000 pounds); Forest Paper Co., Inc., 11.27 cents (300,000 pounds); Bulkley-Dunton & Co., 11.27 cents (200,000 pounds); Butler Co., 11.59 cents (500,000 pounds); 11.77 cents (300,000 pounds); 11.98 cents (200,000 pounds); Tobey-Fine Papers Inc., 11.90 cents (100,000 pounds).

No. 107. Butler Co., 11.39 cents (500,000 pounds); 11.64 cents (100,000 pounds); Aetna Paper Co., 10.71 cents (1,000,000 pounds); Cauthorne Paper Co., Inc., 11.07 cents (200,000 pounds); 11.50 cents (250,000 pounds); Paper Corp. of U. S., 11.49 cents (250,000 pounds); Quaker City Paper Co., 11.07 cents (100,000 pounds); Whiting-Patterson Co., 11.07 cents (300,000 pounds); Merriam Paper Co., 11.09 cents (200,000 pounds); Wilcox-Walter-Furlong Paper Co., 11.07 cents (200,000 pounds); Whitehead and Alliger Co. Inc., 11.07 cents (300,000 pounds); Baldwin Paper Co., Inc., 11.50 cents (250,000 pounds); Bulkeley-Dunton & Co., 11.07 cents (100,000 pounds); Collins Mfg. Co., 9.89 cents (750,000 pounds); 10.25 cents (750,000 pounds); 10.60 cents (750,000 pounds).

No. 108. Collins Mfg. Co., 9.89 cents-10.25 cents-10.60 cents (2,250,000 pounds); Aetna Paper Co., 10.71 cents (1,750,000 pounds).

No. 109. Aetna Paper Co., 12.97 cents.

No. 110. Aetna Paper Co., 13.72 cents.

No. 111. Aetna Paper Co., 10.99 cents (500,000 pounds); 11.99 cents (700,0000 pounds).

No. 112. Collins Mfg. Co., 10.10 cents (200,000 pounds); 10.25 cents (400,000 pounds); 10.74 cents (500,000 pounds); Aetna Paper Co., 10.89 cents (300,000 pounds).

No. 120. Barton, Duer & Koch Paper Co., 15.90 cents.

No. 121. Aetna Paper Co., 12.24 cents.

No. 122. Aetna Paper Co., 12.24 cents.

No. 123. Collins Mfg. Co., 13.49 cents.

No. 125. Paper Corp of U. S., 20.00 cents.

No. 126. Old Dominion Paper Co., 18.48 cents.

No. 128. Paper Corp. of U. S., 19.45 cents.

No. 129. Paper Corp. of U. S., 19.00 cents.

No. 140. Walker-Goulard-Plehn Co., Inc., 23.89 cents.

No. 141. Walker-Goulard-Plehn Co., 22.43 cents.

No. 151. Aetna Paper Co., 6.98 cents.

No. 154. Collins Mfg. Co., 9.935 cents (100,000 pounds); Aetna Paper Co., 10.24 cents (Balance).

No. 155. Collins Mfg. Co., 9.935 cents (100,000 pounds) 10.60 cents (50,000 pounds).

No. 156. Collins Mfg. Co., 10.29 cents (100,000 pounds); 10.79 cents (100,000 pounds); 10.99 cents (100,000 pounds).

No. 160. Collins Mfg. Co., 12.80 cents.

No. 161. Collins Mfg. Co., 12.80 cents.

No. 162. Collins Mfg. Co., 13.10 cents.

No. 168. Paper Corp. of U. S., 17.06 cents.

No. 169. Paper Corp. of U. S., 17.06 cents.

No. 170. Walker-Goulard-Plehn Co., Inc., 18.89 cents.

No. 176. Paper Corp. of U. S., 20.45 cents.

No. 177. Paper Corp. of U. S., 20.45 cents.

No. 183. Perkins-Goodwin Co., 7.24 cents.

No. 184. Barton, Duer & Koch Paper Co., 6.37 cents.

No. 189. Aetna Paper Co., 9.94 cents.

No. 190. Barton, Duer & Koch Paper Co., 10.39 cents (400,000 pounds); 10.73 cents (400,000 pounds); 1.96 cents (400,000 pounds).

No. 191. Barton, Duer & Koch Paper Co., 10.94 cents.

No. 192. Aetna Paper Co., 9.97 cents.

No. 195. Walker-Goulard-Plehn Co., 19.89 cents.

No. 196. Walker-Goulard-Plehn Co., 19.89 cents.

No. 201. Walker-Goulard-Plehn Co., 7.42 cents (starch sized).

No. 202. Walker-Goulard-Plehn Co., 7.82 cents (starch sized).

No. 203. Whitaker Paper Co., 6.80 cents.

No. 205. Whitaker Paper Co., 11.23 cents.

No. 208. National Pulp and Paper Co. Inc., 4.50 cents (car-lots).

No. 209. Frank Parsons Paper Co., 4.29 cents.

No. 210. Whitaker Paper Co., 4.50 cents.

No. 211. Paper Corp. of U. S., 7.41 cents.

No. 213. R. P. Andrews Paper Co., 18.00 cents (for 280 pounds); Paper Corp. of U. S., 18.49 cents (160 pounds).

No. 215. Paper Corp. of U. S., 19.23 cents.

No. 217. Mathers-Lamm Paper Co., 4.41 cents.

No. 218. Mathers-Lamm Paper Co., 4.41 cents.

No. 219. Mathers-Lamm Paper Co., 4.16 cents.

No. 252. Butler Co., $10.56 cents per M sheets.

No. 254. R. P. Andrews Paper Co., 7.23 cents.

No. 255. Whitaker Paper Co., 7.37 cents.

No. 265. Paper Corp. of U. S., 7.25 cents.

No. 271. Barton, Duer & Koch Paper Co., 5.98 cents (Balance); Paper Corp. of U. S., 5.97 cents (150,000 pounds).

No. 276. Barton, Duer & Koch Paper Co., 8.25 cents.

No. 277. Barton, Duer & Koch Paper Co., 9.25 cents.

No. 280. Mudge Paper Co., 10.25 cents.

No. 281. Paper Corp. of U. S., 4.93 cents.

No. 302. Bradner-Smith & Co., $31.13 per M sheets.

No. 303. Bradner-Smith & Co., $44.79 cents per M sheets.

No. 304. Bradner-Smith & Co., $64.79 per M sheets.

No. 305. Bradner-Smith & Co., $38.98 per M sheets.

*(Continued on page 37)*

# Newsprint Compensation Rates Undecided

## Tonnage Provided by Producers to Customers of Other Newsprint Concerns Yet Undetermined — Production of Mills Has Been Reduced by Curtailment of Power—Iroquois Falls Plant is Idle.

[FROM OUR REGULAR CORRESPONDENT]

TORONTO, Ont., November 30, 1942—The rates of compensation to be paid to Canadian mills in respect to tonnage provided by them to the customers of other Canadian newsprint companies have not been determined yet, G. T. Clarkson, receiver and manager of Abitibi Power and Paper Company, Ltd., announced this week. The productive capacities of the mills have been reduced by the withdrawal from them of power and other facilities, for use in war industries. It was not possible, therefore, at this time, Mr. Clarkson said, to compute the earnings of Abitibi and its subsidiaries for the month of October, 1942.

"As the quantities of newsprint which may be produced and supplied by any Canadian newsprint mill, during any month, are also subject to the direction of the newsprint administrator, and to variation by him at any time or times within such month," said Mr. Clarkson, "it is also not now possible to anticipate the quantities of newsprint which Abitibi mills will produce in any future month. Under these circumstances, issue of monthly statements as to the earnings and productive shipments of Abitibi mills will have to be suspended until such time as it shall again become possible to compute the same with approximate accuracy."

### Iroquois Falls Plant Idle

J. J. Lavallee, secretary Local 100, International Brotherhood of Paper Makers at Iroquois Falls, complains in a Toronto newspaper about idle paper machines in that district and proceeds to "explain fully the situation existing here in the newsprint mill of the Abitibi." The complaint continues:

"At present there are two machines down here out of seven, and we believe they should be running. The principal reasons being given at present for paper machines being shut down are the shortage of help and the shortage of power, both of which are needed in more important war industries. As to the former, all the skilled help on the two machines shut down are still here, though working on lower paid and rated jobs. All the extra help required to run the mill at capacity would be some unskilled help who could be recruited from youths not of military age and from men not physically fit for the army.

### Power Not Usable For War Work

"As for the power situation, the company has enough 60 cycle power (60,000 h.p.) which cannot be used in any war industry, to run all seven machines full time. They also have 30,000 h.p. of 25 cycle, which is at present going to Sudbury, and an extra 30,000 variable h.p. which they are using here because Sudbury has not asked for it yet. In other words, even if Sudbury, the only place with high priority rating which can use the power the company here has extra, were to call for all the 25 cycle power the company develops, they could still run all seven machines here six days per week on the 60 cycle power they have here and which cannot be used elsewhere."

The union secretary points out that published statements claimed that one of the difficulties of the newsprint industry was to obtain mills in areas where power was not so badly needed for war industries and says that this statement does not coincide with the situation as he sees it, and concludes:

"We would appreciate greatly if you would explain to us why the mill here has two machines down under these conditions and what the prospects of starting them up are."

Comment on the statements of the union secretary was not immediately available from Abitibi officials, but other sources claim that the Iroquois Falls situation is not quite so simple as the union secretary seems to think.

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## Wisconsin Mills Run Thanksgiving

[FROM OUR REGULAR CORRESPONDENT]

APPLETON, Wis., November 30, 1942—Almost all of the Wisconsin paper and pulp mills remained in operation Thanksgiving day, in order to keep production up to a sufficient level to keep pace with orders. Some mills have government contracts or subcontracts and therefore found it necessary to maintain their usual shifts. Many of the offices were closed, however.

Practically all of the machine shops in mills of the Fox River Valley are now being utilized for war work. Extra mechanics have been employed by many, utilizing all available equipment to fulfill orders for government sub-contracts. They are making parts which are delivered to assembly plants for various types of armed equipment. These operations are carried by many establishments on a 24-hour day basis.

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## Book and Printing Paper Prices

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 2, 1942—OPA has announced all sales under contract made by manufacturers of book and printing papers, as well as all other types of sales, are subject to the General Maximum Price Regulation.

The interpretation, issued by OPA officials in response to inquiries from manufacturers, emphasized that sales under all kinds of contracts are covered by the regulation, including those providing for interim price adjustments even though the contracts are written on an annual basis. Cost-plus or index-prices contracts, under which prices are adjusted periodically to reflect fluctuations in overall or stipulated costs, are included in the scope of the regulation and are not expected.

The regulation establishes ceilings at the levels of prices last March.

# Demand for Paper Still Strong in Midwest

## Wartime Perplexities Have Little Effect Upon Heavy Demand For Major Grades of Paper—Prices Are Firm at Ceiling Levels —Tribune Comments on "Paper Shortage"—Other Market News.

[FROM OUR REGULAR CORRESPONDENT]

CHICAGO, Ill., November 30, 1942—Buried under an avalanche of regulations and orders affecting both their business and private lives, members of the Chicago paper industry still reported a strong demand coming from buyers well aware of the ultimate effect of not only direct curtailment but of shipping and employment problems as well. Local offices reported good demand in all lines with prices running at peak ceiling levels as mills reported less and less possibilities of filling demand. Kraft papers were said to be leading the group in over-all strength but all grades of sulphites, groundwoods, newsprints and book and cover papers were likewise being purchased by buyers who sense the heavy consumer demand in the next few months as compared to the curtailment of pulp production. Waste papers likewise showed a stronger tone as collections were taken up by buyers.

### Paper Man Speaks Before Chemists

The National Chemical Conference, a Chicago "headline" meeting this week, got the attention of chemists employed by leading paper manufacturers, particularly inasmuch as Allen Abrams, vice president of the Marathon Paper Mills, was one of the many noted speakers discussing the possibilities of raw material substitutes. Mr. Abrams told the audience that approximately 90,000,000 gallons of alcohol, enough to make 90,000 tons of synthetic ruber, is obtainable from waste in the pulp and paper industry of the United States and Canada. Only 5 per cent of the wood cut in America is used by the pulp and paper industry but from that small percentage is coming a variety of synthetic and substitute products ranging from synthetic gaskets for military tanks to flavoring for the army's confections and bakery goods, Mr. Abrams pointed out.

Using one example, Mr. Abrams said that "one pulp mill is producing lignin sulfonoate salts for dispensing and emulsifying uses; tanning agents to supplant those cut off from abroad; lignin fillers suitable for use with synthetic rubber in gaskets for military tanks; grinding and dispersing aids for quick settling Portland cement; and quinillin, the flavoring used in confections and bakery goods for our doughboys."

Another feature of the sessions was a preview of food containers showing the trend toward cardboard cans with cellophane linings. Domestic front advances might seem to be less dramatic than developments helping the military front but chemists marveled at the use of cardboard which they said "would characterize the packing and distributing of a wide variety of commodities in the future."

### Tribune Discusses "Paper Shortage"

The Chicago *Tribune* devoted almost an entire editorial column this week to a discussion of "paper in wartime." It discussed the slashing of production well below the six months level ending September 30 as "another evidence of the unremitting hostility of the administration to the press." The editorial stated that the cut could not be justified as a war measure, would not make available any additional man power, material or electric power for use in munitions making. The *Tribune* took particular pains to point out that the War Man Power Commission had classed wood pulp manufacturing as not essential to the war except for the making of paper cups and to add that "it is for the people to say whether they consider the only essential use for paper is in making drinking cups."

### Container Portrays War Uses

One of the more interesting mailing pieces perfected in Chicago recently is that of the Container Corporation of America, headed "Paperboard goes to War." It adequately lets the public know about other and more varied uses for board in the making of airplane parts, tank parts and in the handling and transportation of ammunitions, foods and other war essentials. There are a number of fine illustrations supplied through the courtesy of the Signal Corps and the entire 32 page mailing should be very useful to the entire industry in dramatically telling the story of paperboard's contribution to the war effort.

### New Graham Institutional Copy

Southern Illinois customers of the St. Louis house of the Graham Paper Company are commenting favorably on a new series of advertising pieces, institutional in character, featuring the resources of our South American neighbors. Four have already been issued in the series, pertaining to Colombia, Brazil, Peru and Bolivia. The copy sticks closely to interesting items on these countries with only the back page devoted to the company's policy of urging the printing industry to work for continuation of advertising during the war itself.

### Delivery Problems Acute

The advent of gasoline rationing has thrown the Chicago market into an uproar. Early reports of gas allowances show some drastic curtailments which mean either error in filling out certificates of necessity on the part of paper truck owners, or a general marked curtailment for the war period. Operations problems are accentuated by the busy character of the season, by the new 3% transportation charges contained in the 1942 Revenue Act and by a shortage of man power which will combine to make jobber deliveries in 1943 a most harassing and difficult project.

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## H. T. Tewksbury Joins Navy

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., November 30, 1942—Hamilton T. Tewksbury, son of L. B. Tewksbury, of Spaulding & Tewksbury Company, Inc., boxboard dealers, has joined the U. S. Navy as an apprentice seaman. His home is in Hingham, Mass.

# Newsprint Situation Continues Uncertain

## Meetings Between Canadian Government Officials and Newsprint Manufacturers Have Resulted in No Definite Steps For Curtailment—Drastic Reduction is Expected As Labor Shortage Grows.

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 1, 1942—Coming restrictive control of newsprint on a continental basis and of a drastic nature, to be applied "shortly or before the end of the war," is still the main topic of discussion in newsprint circles. Meetings between government officials and newsprint men have been extended to include newsprint publishers, but as yet no definite steps have been taken to force curtailment in consumption beyond the order limiting production to the average for the six months ended September 30. Publishers have voluntarily curtailed consumption in many cases, however, by cutting down the number of pages in their publications and limiting features.

### Producers Want Higher Prices

Among manufacturers of newsprint there is a strong demand for an upward revision in the price of newsprint as a corollary of any further restriction in production. Whether or not this can be arranged is still uncertain. Transportation, labor and other costs have mounted while the profit margin has dwindled or disappeared under present production schedules and prices. So far the United States Government price control and priorities have rejected efforts to obtain price adjustments in newsprint, but any further forced curtailment of mill schedules would strengthen the case of the mill operators in getting better prices.

### Labor Shortage More Serious

Meanwhile the labor difficulty is looming up as the most serious factor in the situation. Apart from the diversion of men to the armed forces and to war industries, the war demand for lumber is mounting rapidly and causing diversions from cutting of pulpwood to cutting of logs for sawmills. In eastern Canada the situation is further complicated by increasing demand from Great Britain for lumber. In New Brunswick the government has issued an appeal to lumbermen to speed up production. In Quebec the Hon. Wilfrid Hamel, Minister of Lands and Forests, has estimated that, due to war needs, the cut of lumber this winter will be doubled. As regards the cutting of pulpwood for newsprint he anticipates a reduced cut primarily due to the scarcity of skilled labor and only secondarily to the shortage of hydro-electric power, which is being diverted in increasing measure to war industries.

### To Reduce Paper Bag Sizes

By terms of an order of wartime Prices and Trade Board, paper bags used for various commercial purposes must henceforth be manufactured in fewer sizes and from prescribed weights of paper. C. V. Hodder, administrator of paper boxes, envelopes and packages for the Prices Board, states that with fewer sizes in production, larger runs can be attained and a reduction achieved in idle machine time caused by changing of sizes.

### Winchester Paper Mill Sold

A press report relates the "old Winchester, Va., paper mill, which has been operated under a number of ownerships and has passed through numerous chapters, now enters upon still another one, it was learned last night.

"Owned for the past 8 years by the Eddy Paper Corporation most of which time it was closed down, except a brief period last year when it was opened for operation again, the plant was sold several months ago in its entirety to the Hetz Construction Company, of Warren, Ohio. This firm specializes in liquidating industrial firms.

"Last night, Clifford D. Grim confirmed the report that he and Fred L. Glaize, Jr., had bought the large brick buildings and six acres of land lying on the east side of the road there.

"All paper manufacturing machinery has been moved out, however. The Eddy Paper Corporation utilized all machinery which is valuable to them in its other mills in this country and Canada, and the remainder was sold to the Hetz Construction Company. The Eddy Paper people have removed four solid carloads of usable machinery.

"They in turn have sold the scrap metal to Hyman Viener, a large junk dealer of Charlestown, W. Va., who is expected to start dismantling the scrap metal today.

"Mr. Grim asserted last night that he and Mr. Glaize plan to utilize the property as soon as the old machinery is moved out. While he would not divulge the purposes to which it will be put, it is understood that these prominent Winchester business and financial men are planning to convert it into some type of apple products use."

### W. G. Latham Fills Unusual Job

CASTLETON, N. Y., November 23, 1942—W. Gordon Latham, president of the Fort Orange Paper Company, is now filling one of the war's most unusual jobs, the discovery and fabrication of paper products as substitutes for critical metals. He has been placed in charge of the development section of the War Production Board's Pulp and Paper Branch and has assembled a staff of leading technicians to develop waterproof, bullet-resisting and other special papers, including pressed papers to replace aluminum and steel in some airplane parts. The job, according to Mr. Latham, means that paper has gone to war. Mr. Latham, rated among the country's leading paper box producers, has been an adviser to the War Production Board since last May and only recently was assigned to his present position at $1 a year. Mr. Latham won his spurs of national distinction in the paper industry on the home ground. He was born in Woolsey, Ga., member of a New England family, and joined the Fort Orange Paper Co. in 1912. The firm is doing war work also, turning out packages for cartridges, emergency rations and other goods.

# *Higher Finishes—*

## with

# KOTECELE "B"

## *Through*

## —Leveling-Off Ability

**Mixes made with Kotecele at the high solids needed for rapid production still level off after application and so lay the foundation for effective calendering.**

## —Uniform Binder Distribution

**Improved water retention due to the high solids keeps Kotecele uniformly distributed through the pigment. This prevents dusting at the calenders and permits low percentages of binder to be used in the coating, resulting in higher finishes.**

**Our Paper Technicians will be glad to give you full particulars. Write to**

# NATIONAL STARCH PRODUCTS Inc.

820 GREENWICH STREET, NEW YORK

# WAR NEEDS IS THEME AT POWER EXPOSITION

*(Continued from page 7)*

Representatives in attendance included C. G. Dandrow, E. D. Flavin, C. B. Bradley and G. F. Barnett.

### Lovejoy Flexible Coupling Co.

The exhibit of the Lovejoy Flexible Coupling Company featured a photograph of some very large couplings recently made which measure 30-inches in diameter, and which are good for 100 hp. at 100 rpm. In the same frame was shown the company's 1A-050 coupling which is good for 1/6 hp. at 1750 rpm. and is used on oil burners.

In attendance were Ernest Pauli, Fred K. Stone, H. M. Metz and C. C. Ross.

### Nash Engineering Co.

The exhibit of the Nash Engineering Company featured the Nash Pyrex Glass Pump for handling alum. A Dryer Exaust Unit Pump for handling concentrate was also on display.

Representatives in attendance were C. L. Clark, George Wright and Fred Green.

### Packless Metal Products Corp.

The display of the Packless Metal Products Corporation included an attractive background arrangement of flexible hose lengths ranging from 14-inches in diameter to 10-inches in diameter and a display of copper tubes with Packless Self-Flaring fittings attached. Also on display was a sectional bin containing Self-Flaring Copper Tube fittings in sizes from ¼ inch to 1 inch.

### Revolvator Co.

The exhibit of the Revolvator Company featured its line of industrial elevators for saving space, labor and cost. Several types for handling paper rolls, cases, sheets, drums, bags and miscellaneous and odd shapes were on display.

Representatives of the company in attendance included H. S. Germond, Jr., Paul Germond, H. S. Germond, 3rd, H. V. Stoddard, and R. Sturtevant.

### J. E. Rhoads & Sons

The exhibit of J. E. Rhoads & Sons featured a testing unit comparing the relative merits of the concern's Tannate Flat Leather Belting with oak and rubber belt. A Tannate-Rockwood drive unit which automatically controls belt tension, was also on display.

Representatives in attendance included J. Edgar Rhoads Richard H. Rhoads, Samuel L. Allen, Herbert T. Darlington, A. N. Lamb, George J. Schullein, John J. Merz and C. D. Wright.

### Socony-Vacuum Oil Co.

The exhibit of the Socony-Vacuum Oil Company featured the company's circulating oil system for Diesel engines, and the lubricating system developed for the Uniflow Steam Engine. Lucite models showing lubrication for Diesel engines and models showing the oil wedge in gears and in bearing lubrication were also displayed.

The representative of the company in attendance was T. E. Dial.

### John Waldron Corp.

The exhibit of the John Waldron Corporation featured the Waldron and Francke Couplings, and the Silent Steel Gear. The display consisted of running models of the couplings made of transparent materials to show how the coupling functions and how it is automatically lubricated. Also on exhibit were cut-away models of couplings of different types. The Silent Gear was a mechanical exhibit demonstrating the silent features of the Silent Gear in contrast with the solid steel gear.

Representatives in attendance included L. D. Litsey, J. A. Clark and Horace Field.

### Yale & Towne Mfg. Co.

The display of the Yale & Towne Manufacturing Company included no actual equipment as in former years. On display were bulletins describing the concern's varied line. The Load King Trailer, providing speed in materials handling operations and cutting costs 50% was emphasized. The special feature was a motion picture of Yale & Towne products in industry.

Representatives at the exhibit included R. E. Wilson, C. K. Drury, Earl Clapp and George Sherill.

## Donate Materials for Service Club

[FROM OUR REGULAR CORRESPONDENT]

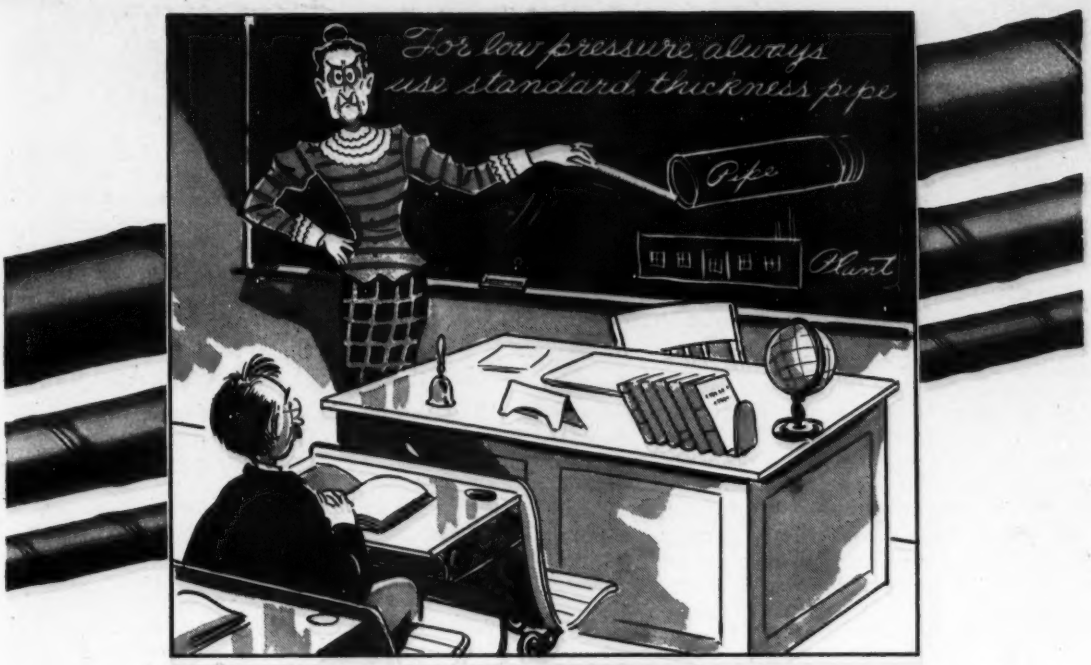
BOSTON, Mass., November 30, 1942—Paper concerns were prominently represented among those who donated materials or supplies to the Bay State Service Club for servicemen on Boston Common which cost only $26 which sum was for the Boston building permit. Among the donors were Bird & Son, Inc., who gave shingles, brick siding and chromalite floor covering; Masonite Company, which supplied hardboard, and Haverhill Boxboard Division of the Robert Gain Company, which presented wall board. Paper for stationery sufficient to print 100,000 letterheads came from Tileston & Hollingsworth Company. Programs for the dedication were printed on Strathmore's "Fiesta," donated by Carter, Rice & Co. Printing for tickets of admission, letterheads, invitations and programs were contributed by Callaway Associates, Court Square Press, Copley Printing Company, Richmond Printing Company and Cecil Wrightson, Inc. Thus the allied industries showed their patriotism and civic interest.

## Paper Inventory Index

[FROM OUR REGULAR CORRESPONDENT]

WASHINGTON, D. C., December 2, 1942—September index of the value of paper manufacturers' inventories was 154.7 compared with 154.6 in August and 125.4 in September of last year, taking the average month of 1939 at 100, according to the monthly industry survey of the Department of Commerce.

Index of the value of paper manufacturers' shipments, taking an average month of 1939 at 100 was 135 in September, compared with 131 in August, and 165 in September of the previous year.




# Meet Miss Application of the old school—

SHE'S been the "school marm" of a certain well-intending school of thought for many a year . . . and you're correct in suspecting that her name is usually spelled MISAPPLICATION!

When materials were plentiful, few men questioned her doctrines. But now there is scarcity, and industry, on the alert to check all forms of waste, has discovered that *Mis-application* can be one of the worst offenders.

There are endless examples of this, but a particularly good one is found in industry's time honored practices in selecting pipe. The piping requirement may involve simply low or very moderate pressure water, air or exhaust steam, yet our old friend "Miss Application" says: "It's low pressure so just order standard thickness pipe the way I've always told you."

The fact is, however, that light but strong Taylor Spiral Pipe would in *most* cases handle the job with a big saving of now-vital steel! It's a fact too, that a big dollar saving usually results . . . that the installed cost of Taylor Spiral Pipe is often no more than half that of standard thickness pipe.

Yes, switching to Taylor Spiral Pipe saves money and conserves steel. Use it for all such services as those listed here.

**Change to TAYLOR SPIRAL PIPE FOR:**

- High and Low Pressure Water Lines.
- Low Pressure Steam and Air Lines.
- Steam and Diesel Exhaust Lines.
- Vacuum and Suction Lines.
- Blower Piping.
- Sand and Gravel Lines.
- Industrial Gas Lines.
- Oil and Gas Gathering Lines.
- Swing Pipe.
- Spray Pond Piping.
- Hydraulic Mining.
- Dredge Lines.

The broad range of Taylor Spiral Pipe fits it into this scheme of better pipe selection perfectly. Sizes range from 4 to 42 inches—thicknesses from 18 to 8 gauge. All types of end joints; all kinds of fittings, "specials" and fabricated assemblies are produced by Taylor Forge, assuring complete service and undivided responsibility.

**TAYLOR FORGE & PIPE WORKS**

General Office & Works: Chicago P.O. Box 485
New York Office: 50 Church Street
Philadelphia Office: Broad Street Station Bldg.

**TAYLOR *Spiral* PIPE**

# CONSTRUCTION NEWS

*Under limitations order L-41 all projects involving expenditures of more than $5,000 must be specifically approved by the War Productions Board. The status of projects reported herewith under the provisions of the order is not known.*—EDITOR.

**Cornell, Wis.** — The Cornell Wood Products Company, manufacturer of wall board, folding box board and other paper board products, has approved plans for alterations and improvements in one-story building at mill, used for storage and distribution, as well as in office structure. No estimate of cost announced. General construction award has been made to Hoeppner-Bartlett Company, 631 East Madison street, Eau Claire, Wis., and work will proceed at once.

**St. Louis, Mo.**—Fire recently damaged a portion of storage and distributing plant of Western Paper Stock Company, 704 Cass avenue, commercial paper products, with loss reported close to $15,000, including equipment. It is planned to rebuild at early date. Structure is occupied under lease, and is owned by Henry Kraus, St. Louis.

**Philadelphia, Pa.**—The Barrett Company, Margaret and Bermuda streets, manufacturer of prepared roofing products, coal tar specialties, etc., has work under way on new addition to plant, previously referred to in these columns, and will push construction to early completion. Lauter Construction Company, Otis Building, Philadelphia, has the general erection contract.

**Milwaukee, Wis.**—The Milwaukee Lace Paper Company, 1306 East Meinecke avenue, manufacturer of lace and other paper specialties, is awarding final contracts for work for completion of new addition to plant, in course of construction for a number of weeks past, as previously referred to in these columns. It is expected to proceed with equipment installation at early date.

**Carteret, N. J.**—The Westvaco Chlorine Chemical Company, Roosevelt avenue, manufacturer of chlorine, etc., has begun erection of new addition to local plant. It will be used for increased capacity. Erection contract was awarded recently to Wallace J. Wilck, 280 Hobart street, Perth Amboy, N. J.

**Toronto, Ont.**—The Gair Company of Canada, Ltd., Paperboard Mill Division, Commissioner and Carlaw streets, manufacturer of straw board, chip board and other paper board stocks, has approved plans for new addition to mill. General erection contract has been awarded to Russell Construction Company, Ltd., Harbor Commission Building, Toronto, and work will be placed under way at once.

### New Companies

**Chicago, Ill.**—Print Pack, Inc., 208 South LaSalle street, has been organized with capital of $25,000, to manufacture paper packages of various kinds, labels, etc. Incorporators include N. G. Culp and J. Warwick. Company is represented by Seyfarth & Atwood, attorneys, first noted address.

**New York, N. Y.**—American Pressboard Company, Inc., has been chartered with capital of 200 shares of stock, no par value, to manufacture and deal in paper board stocks of various kinds. Company is represented by Sidney C. Norris, 22 West Forty-eighth street, New York, attorney.

## M. J. Burns to be Special Assistant

WASHINGTON, D. C., December 2, 1942 — WPB has announced appointment of the first of a number of labor men to act as special assistants to divisional directors.

The first appointee is Matthew J. Burns, who becomes a special assistant to A. G. Wakeman, director of the Pulp and Paper Division.

Mr. Burns, from 1921-6 was general secretary and from 1929-40 was president of the International Union of Paper Makers of the A. F. of L. He has been on the staff of the WPB Labor Production Division and its predecessor, the Labor Division of Office of Production Management, since April, 1941.

Mr. Burns' appointment is in line with the program for more effective cooperation between labor and WPB which has been developed by Ferdinand Eberstadt, WPB Vice Chairman, Ernest Kanzler, Director General for Operations, and Wendell Lund, Director of the Labor Production Division.

It will be Mr. Burns' responsibility to keep the division director informed as to labor's advice on matters within the jurisdiction of the division. He will likewise be responsible for working out any problems arising in this field.

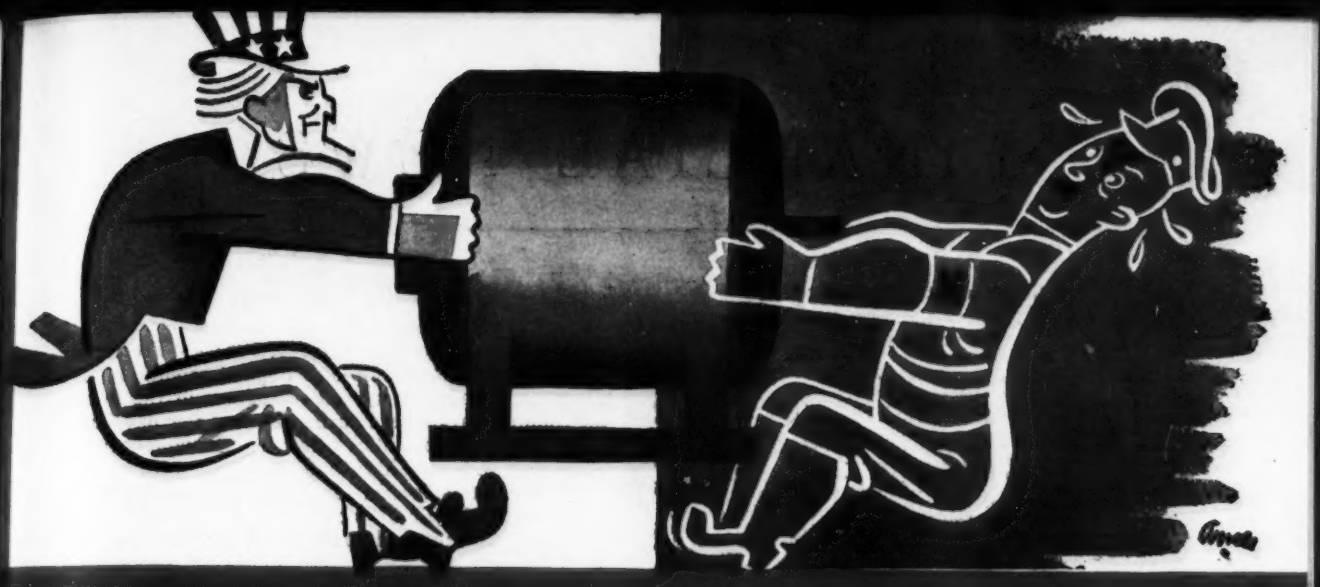
Mr. Wakeman said that he expects to utilize Mr. Burns frequently on special assignments in making analyses and recommendations as to production programs in terms of manpower requirements. Mr. Burns is authorized to call in, through the Labor Production Division, such labor representatives as he may need to advise him on specific problems affecting labor, such as concentration and curtailment orders.

"Having had long acquaintance with Mr. Burns as a representative of the International Union of Paper Makers, I welcome his appointment as an assistant," Mr. Wakeman said.

"In accordance with established procedure, his name was suggested by the Directory of the Labor Production Division, following consultation with President Green of A. F. of L.

## H. F. Dunning Goes To Chester

GLENS FALLS, N. Y., November 30, 1942—H. F. Dunning, manager of the Marinette Paper Company, River street, South Glens Falls, has announced that Henry W. Fales, chief engineer will succeed him as manager. Mr. Fales resides at 40 Garfield street. Mr. Dunning is being transferred to the main plant of the parent company, Scott Paper Company at Chester, Pa., in the capacity of assistant to the vice-president.



# HOW MUCH OF YOUR MOTOR CAPACITY IS ON THE ENEMY'S SIDE?

## APPLY THIS GUIDE

**(based on recommendations of WPB)**

**TO DECIDE UPON MOTOR SIZE**

1. For open-type a-c motors (continuous rated 40 C) where ambient temperatures are generally below 40 C, use motors rated as low as 80% of actual required horsepower. EXAMPLE: Where 9.3 is required horsepower—9.3 ÷ .80 = 7.44; select a 7.5-hp motor.

2. For a-c or d-c motors rated on a 50 C or 55 C basis, where ambient temperatures are generally below 40 C, use motors rated as low as 91% of actual required horsepower.

3. For open-type d-c motors (continuous rated 40 C) where ambient temperatures are generally below 40 C, use motors rated as low as 87% of actual required horsepower.

4. In selecting motor types, base your choice on these conservation factors, wherever operating conditions permit:

***Use standard open motors instead of "specials"—high-speed instead of low-speed—single-speed instead of multiple—single-winding rather than two-winding—a-c instead of d-c—squirrel-cage instead of slip-ring—440-volt motors instead of 220 (or use 2200 volts above 100 hp).***

An up-to-the-minute guide on wartime motor selection is now included with each copy of the G-E MOTOR FITNESS MANUAL, a booklet prepared to help you get the most out of every motor you now have in service. For your copy, call or write your local G-E office.

**MOTORS NEEDLESSLY LARGE FOR THE JOB**—plus the oversize distribution circuits they require—may be 25 per cent or more on the side of the Axis! That's the percentage of copper and other scarce materials frequently wasted by overcautious motor specifications—by buying the "next larger size" than a machine actually needs.

The extra amount of critical material used in the oversize motor itself is only part of the loss. Operating a motor continuously below its rated capacity can mean wasted copper all the way back to the power plant. Thus, even your present motors should be so applied as to avoid "over motoring," wherever possible.

The WPB joins in urging you to modify your peacetime motor policy in the cause of conservation. By following its recommendations whenever you buy or install a motor you'll be helping to make more metals available where they're most needed to win the war. *General Electric Company, Schenectady, N. Y.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

**BUILDER OF TRI-CLAD MOTORS**

**GENERAL ELECTRIC**

# FINANCIAL NEWS

### New York Stock Exchange

High, Low and Last for Week Ending November 28, 1942

| STOCKS | High | Low | Last |
|---|---|---|---|
| A. P. W. | .... | .... | .... |
| Armstrong Cork Co. | 31 | 30¼ | 30¼ |
| Celotex Corp. | 7⅜ | 7¼ | 7⅜ |
| Celotex Corp., pf. | 70¼ | 69 | 69½ |
| Certain-Teed Products Corp. | 3 | 2⅞ | 3 |
| Certain-Teed Products Corp., pf. | 31 | 29⅞ | 30¼ |
| Champion Paper & Fibre Co. | 18⅞ | 18¾ | 18⅞ |
| Champion Paper & Fibre Co., pf. | 100 | 99½ | 100 |
| Congoleum Nairn Co. | 16⅜ | 16 | 16¼ |
| Container Corp. of America | 15⅜ | 15 | 15 |
| Continental-Diamond Fibre Co. | 7 | 6⅞ | 7 |
| Crown-Zellerbach Co. | 11¼ | 11 | 11⅛ |
| Crown-Zellerbach Co., pf. | 80½ | 80 | 80½ |
| Dixie-Vortex Co. | 9 | 8⅞ | 9 |
| Dixie-Vortex Co.—A. | 36¼ | 36 | 36¼ |
| Flintkote Co. | 14⅞ | 14¼ | 14⅞ |
| Robert Gair | 1⅜ | 1⅜ | 1⅞ |
| Robert Gair, pf. | 9¼ | 8⅞ | 9¼ |
| International Paper Co. | 8⅝ | 8 | 8⅝ |
| International Paper Co., pf. | 45 | 44¼ | 44½ |
| Johns-Manville Corp. | 67 | 65 | 67 |
| Johns-Manville Corp., pf. | 129 | 129 | 129 |
| Kimberly Clark Corp. | 26½ | 26 | 26½ |
| MacAndrews & Forbes | 18¼ | 17½ | 18¼ |
| Masonite Corp. | 28¾ | 28¼ | 28¾ |
| Mead Corp. | 6¼ | 5¾ | 5¾ |
| Mead Corp., pf. | 66 | 66 | 66 |
| Paraffine Companies, Inc. | 32 | 31¾ | 31⅞ |
| Paraffine Companies, Inc., pf. | .... | .... | .... |
| Rayonier, Inc. | 9¼ | 8¾ | 8⅞ |
| Rayonier, Inc., pf. | 26¾ | 26 | 26 |
| Ruberoid Co. | 19¾ | 19 | 19⅜ |
| Scott Paper Co. | 37⅞ | 37½ | 37⅞ |
| Scott Paper Co., pf. | .... | .... | .... |
| Sutherland Paper Co. | 24 | 24 | 24 |
| Union Bag & Paper Corp. | 8⅛ | 7¾ | 7¾ |
| United Paperboard Co. | 3½ | 3 | 3 |
| U. S. Gypsum Co. | 60 | 56 | 60 |
| U. S. Gypsum Co., pf. | 173 | 173 | 173 |
| West Virginia Pulp & Paper Co. | 12¼ | 11¾ | 12 |
| **BONDS** | | | |
| Abitibi Pulp & Paper Co. 5s '53 | 50¼ | 48¾ | 48¾ |
| Celotex Corp. 4½s '47 | 98¼ | 97¾ | 98¼ |
| Certain-Teed Products Corp. 5½s '48 | 93 | 92¼ | 92¾ |
| Champion Paper & Fibre Co. 4¾s '50 | 104 | 104 | 104 |
| International Paper Co. 6s '55 | 105⅛ | 104¼ | 104¼ |
| International Paper Co. 5s '47 | 103¼ | 102¾ | 102¾ |
| Mead Corp. 4½s '55 | .... | .... | .... |
| West Virginia Pulp & Paper Co. 3s '54 | 103¼ | 103 | 103 |

### New York Curb Exchange

High, Low and Last for Week Ending November 28, 1942

| STOCKS | High | Low | Last |
|---|---|---|---|
| American Box Board Co. | 5¼ | 4¾ | 5⅛ |
| Brown Co., pf. | .... | .... | .... |
| Great Northern Paper Co. | 26¾ | 26¼ | 26¼ |
| Hummel-Ross Fibre Corp. | 3½ | 3¼ | 3¼ |
| National Container Corp. | 9 | 8¼ | 8½ |
| St. Regis Paper Co. | 1⅝ | 1⅜ | 1⅜ |
| St. Regis Paper Co., pf. | 120 | 119½ | 120 |
| Taggart Corp. | 3 | 2¾ | 3 |
| **BONDS** | | | |
| American Writing Paper Co. 6s '61 | 86½ | 85 | 86½ |

## Rayonier Nets 22 Cents

The Rayonier, Inc., for the quarter ended October 31, reports a net profit of $527,757, or 22 cents a share, against $550,541 (revised), or 25 cents a share, in preceding quarter, and $935,760, or 65 cents a share in like 1941 quarter. Six months to October 31, net profit $1,078,298, or 47 cents a share; for like 1941 period, $1,770,743, or $1.19 a share.

## Hinde-Dauch Vote Dividend

The Hinde & Dauch Paper Company has voted a distribution of 75 cents a share on the common stock, payable December 29 to stockholders of record December 1. This brings total payments for the year to $1.50, the same as last year.

## Quebec Co. Stock Active

[FROM OUR REGULAR CORRESPONDENT]

MONTREAL, Que., December 1, 1942 — Preferred stock in the Quebec Pulp and Paper Corporation, of Chicautimi, has been an active feature in the over-the-counter market here during the past few days and has shown a substantial advance. It is currently quoted at 29½ to 30½, indicating an advance of about 7 points since the latest move got under way. This is not the first time this year that this issue has had strong upward spurts. Earlier this year the price held under 5, then during the summer it had an advance to 14 on appointment of a preferred shareholders' committee. It then fell back to around 9, but after an interval renewed strength appeared and the issue rose above 24 last month when the company was placed in bankruptcy. This step was regarded as clearing the way towards some arrangement which will effect a change following the company's inactivity since 1930.

## B. C. Stockholders To Approve Plan

[FROM OUR REGULAR CORRESPONDENT]

VANCOUVER, B. C., November 30, 1942 — Shareholders of the 7% general mortgage sinking fund gold bonds of the British Columbia Pulp and Paper Company, Ltd., are being invited at the annual meeting of the Company in Montreal to approve a plan for liquidation of arrears of interest that fell due on and prior to May 1st, 1942, and for deferment of payment of interest accruing between May 1st, 1942, and May 1st, 1945, until November 1st, 1945.

The plan calls for payment of $430,917 in cash within the next year and postponement of further regular interest payments until Nov. 1, 1945. The settlement reflects improvement in the company's position in recent years. In the three years ended Dec. 31, 1941, the company brought interest payments on first mortgage bonds up to date; met three semi-annual coupons on general mortgage bonds and in addition increased net working capital from $143,469 at end of 1939 to $960,679 at end of 1941.

## A. P. W. Co. Earns $2,188

The A P W Paper Company, Inc.—July 1 to Oct. 24: Net profit, $2,188 after all interest, including interest payable only if earned on $760,487 of 6% convertible notes and after providing $38,000 for contingencies and estimated Federal income and excess-profits tax of $35,500. Provision has been included of $3,315 as of October 24 for additional contingent interest of 1 per cent on first-mortgage bonds with warrants. Net profit for similar period last year was $27,298 after all interest charges.

## R. W. Mayhew Made Director

[FROM OUR REGULAR CORRESPONDENT]

VANCOUVER, B. C., November 28, 1942—R. W. Mayhew, president of Sidney Roofing and Paper Company, Ltd., Victoria, B. C., has announced appointment of Patrick W. Field, general sales man-

# Ready—Willing AND Able

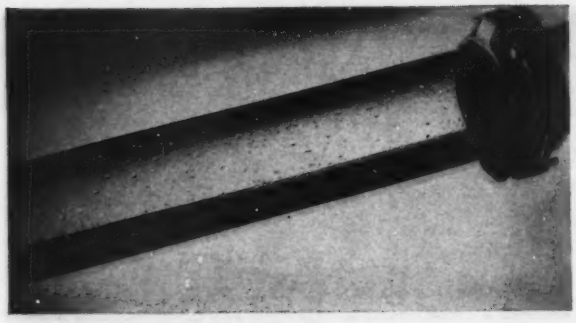
• Efficient paper production calls for rugged felts that can *deliver* under any circumstance. Felts that can take the punishment of high speed operation, respond to emergency conditions—save time by requiring less frequent change. • Huyck felts are ready, willing and able to make good—whatever the demand upon them. They are known to papermakers everywhere for their sturdy durability and exceptional water removal qualities. • For long life under strenuous operating conditions, specify Huyck Felts.

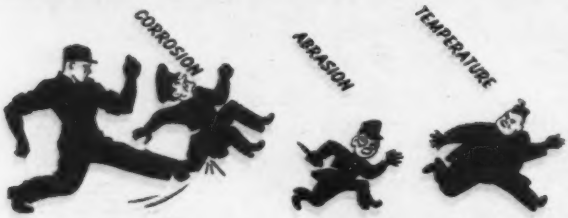
## F. C. HUYCK & SONS

*Established 1870*

**KENWOOD MILLS • ALBANY, N. Y.**

KENWOOD WOOL PRODUCTS






## PYREX Piping Whips All Three

The plant equipped with PYREX Pipe Lines and other PYREX products is armed for a long pull at a time when many other materials will be hard to get. Here are the reasons why this resistant piping stands up under tough combinations of corrosion, abrasion and temperature.

**CORROSION**

PYREX Piping has remarkable resistance to all acids in solution (except HF).

**ABRASION**

PYREX Piping, because of its hard smooth surface, has 2 or 3 times the abrasion resistance of ordinary plate or bottle glass.

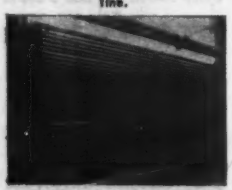
**TEMPERATURE**

PYREX Piping withstands ordinary thermal shocks at operating temperatures up to 250° F. and under certain circumstances can be used at temperatures up to 500° F.

Today hundreds of miles of PYREX Piping are now doing 24-hour duty in the food, paper, chemical and other industries where durability is essential. Corning engineers will gladly cooperate in applying this piping to your particular problem. Write today to Industrial Division, Corning Glass Works, Corning, N. Y.

Branch Offices: New York, 718 Fifth Ave.; Chicago, Merchandise Mart.

Sulphuric acid and crushed quartz line.



PYREX Cascade gas cooler carrying hot ammoniacal liquor.

Chemical laboratory drain line.

Lines conveying sodium carbonate solution, brines and wet chlorine gases.

*"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.*

CORNING Glass Works Corning, New York — Pyrex Industrial Glass


ager and manager of the company's Vancouver office, to the board of directors. Mr. Field has been with the Sidney Roofing and Paper Company, Ltd., for the past 14 years and is a well known and popular figure in provincial construction circles. He is a member of the Rotary Club, is on the council of the Vancouver Board of Trade, and is a past chairman of the B. C. Products Bureau.

## National Container Nets $1.76

The National Container Corporation and subsidiaries for the nine months to September 30, reports a net adjusted profit after all taxes and charges totaled $583,357, equal to $1.76 a share, compared with $882,035, or $2.49 a share, last year; combined net sales, $8,153,766, against $7,305,305. Samuel Kipnis, president, states that the company has on hand $1,002,666 of Series B tax-savings notes reserved for future income and excess profits tax payments.

## S. D. Warren Votes Dividends

[FROM OUR REGULAR CORRESPONDENT]

BOSTON, Mass., November 30, 1942—At a meeting of the board of directors of the S. D. Warren Company, November 30, it was voted to declare a dividend of 25 cents per share on the common stock, payable December 24 to stockholders of record December 16.

## Eastern Corp. Nets $1.56

The Eastern Corporation for the nine months to September 30, reports income was $328,461 after $643,000 Federal taxes, equal after preferred dividend requirements, to $1.56 each on 200,045 common shares, against $548,307, or $2.63 each on 200,051 common shares, last year.

## Gaylord Declares Dividend

The Gaylord Container Corporation has declared an extra dividend of 12½ cents a share on the common stock in addition to the quarterly distribution of 12½ cents, both payable December 15 to stockholders of record November 30. Similar extras were voted in the preceding quarters.

## Albemarle Co. Loses

The Albemarle Paper Manufacturing Company for the six months to September 30, reports a net loss of $11,246, contrasted with net income of $232,304 for six months to September 30, 1941; net sales, $1,960,871, compared with $2,458,477.

## National Gypsum Votes Payment

The National Gypsum Company has voted a dividend of 25 cents a share on the common stock, payable December 30 to stockholders of record December 23. Previous payment was 40 cents made December 20, 1941.

## Hammermill Votes Dividend

The Hammermill Paper Company has declared a dividend of 25 cents on common, payments this year total $1, or 25 cents less than last year.

# Obituary

## John Brannan

[FROM OUR REGULAR CORRESPONDENT]

FULTON, N. Y., November 30, 1942—John Brannan, aged 74, president of the North End Paper Company, died Friday, November 20, in University hospital in Syracuse, after an illness of two weeks.

A native of Fulton, Mr. Brannan was a son of John Brannan, native of Canada, and Elizabeth Wood Brannan, native of Ireland. He was a past president of the State Papermakers association, a member of the Elks club, Knights of Columbus and the Fulton club.

Surviving are his wife, Mrs. Helen M. Brannan; a granddaughter, Kathleen; a grandson, Harry Plum, jr., in the navy; a daughter-in-law, Mrs. Anna Brannan; four sisters, Miss Anna Brannan, Mrs. Ray Loveless and Mrs. M. M. Conley of Fulton and Mrs. James Hopkins of Syracuse; and a brother, James R. Brannan.

## Philip Weston Jr.

PITTSFIELD, Mass., November 26, 1942—Aviation Cadet Philip Weston Jr., son of the late president of the Byron Weston Paper Company, of Dalton, Mass., was killed last night in the crash of an Army plane at Grand Ridge, Fla., according to word received here today. He was twenty-five years old.

Mr. Weston was born April 30, 1917, soon after the United States entered the first world war. He attended the Fessenden and Taft Preparatory Schools and entered the paper mill at Dalton, which was founded by his grandfather, former Lieutenant Governor Byron Weston of Massachusetts, in 1867. He became an Air Force cadet last May and was stationed at Bainbridge, Ga.

Surviving are his mother, Mrs. Theodore Pomeroy Weston, and two sisters, Mrs. Stuyvesant Morris Pell and Mrs. John Anthony Brownell.

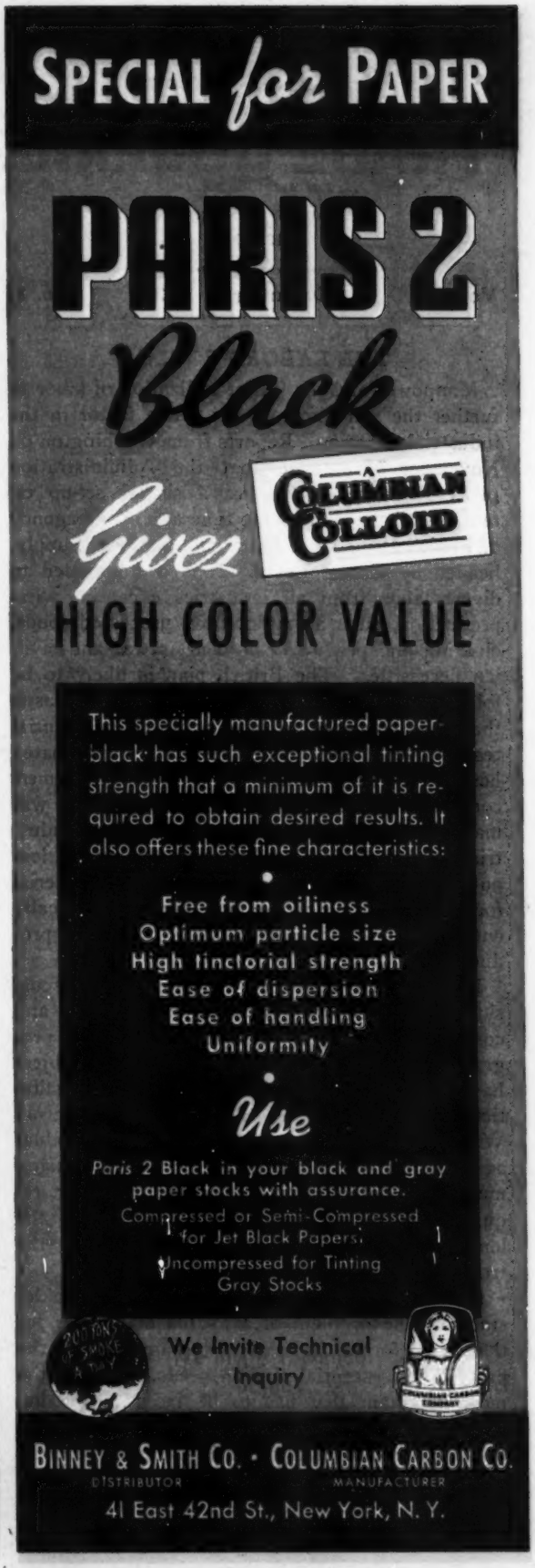
## Ira T. Fisk

[FROM OUR REGULAR CORRESPONDENT]

HOOSICK FALLS, N. Y., November 30, 1942—Ira T. Fisk, 67 years old, retired paper mill superintendent, died this week suddenly from a heart attack. He had been undergoing treatment for some time. He left school at an early age to enter the employ of the Stevens & Thompson Paper Company and was in their employ for a half century, retiring two years ago after being general superintendent of the branches at North Hoosick and at Walloomsac. He was prominent in civic affairs. He was also a director of the People's First National Bank of Hoosick Falls. The principal survivors are his wife, a son and two sisters.

## Cyrus H. Taber

HOLYOKE, Mass., November 30, 1942—Cyrus H. Taber, 85, of 122 Pleasant street, president of the American Pad and Paper company and vice-president of the People's Savings bank, died November 20 at Holyoke hospital. Mr. Taber was one of Holyoke's industrial pioneers for prior to his connection with the paper industry he operated a printing shop and later did some trading in real estate.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Vol. 115 December 3, 1942 No. 23

## THE LABOR PROBLEM

Manpower and the fullest utilization of labor to further the war effort, is the prime factor in the industrial situation. Reports from Washington on November 26 indicate that the Administration plans to create in America a similar set-up established in England some time ago in the agency of British Ministry of Labor and National Supply, headed by Ernest Bevin. It is contemplated to divert labor from all industries excepting vital production, such as agriculture, processed foods, clothing and products classified as war and civilian necessities. The British plan is likely to be followed as closely as practicable, for the reason that it is conceded to have achieved substantial results over there and like results are anticipated here. The establishment of a close government control over the manpower of the nation will mark the first step to drastically curtail all industrial output. With less labor in the woods, less pulpwood will be cut, yielding less basic material for manufacturing wood pulp and automatically curtailing the production of paper and paper products.

Much general and not very informative discussion of the manpower situation has appeared and continues to appear in the press and on radio programs. A rational consideration of the subject has been lately issued by the Brookings Institution, Washington, D. C. This booklet, by Harold W. Metz, surveys the estimated national product available for war purposes, methods of increasing manpower, potential production per man-year, requirements for an armed force, relation to the lend-lease problem and ships to transport the troops.

In stating the manpower problem the booklet states: "The problem of available manpower for the armed forces, for war production, and for the provision of essential civilian needs, is one of the most important that has to be faced in the immediate future. The Select Committee on National Expenditures of the British House of Commons stated the question well in its report of March 26, 1942, when it said: 'What distribution of labor between industry and the armed forces will secure the maximum strength for defeating the enemy, taking into account the combined resources of this country and her Allies? That is the basic question of manpower policy.' This statement is as applicable to the United States as it is to England. Much public confusion has resulted from conflicting statements issued by government officials, both with respect to the ultimate size of the armed forces and the possibility of labor shortage. . . . In order to determine whether we have enough manpower to maintain an armed force of the size indicated (10 million men), we should know how much equipment and supplies are required per man per year, and also the amount of labor required for their production. Official estimates of these requirements are not available."

After surveying all the major aspects of the manpower problem the following conclusions are presented: "In establishing an armed force of 9.5 million men( while producing about 84 billion dollars of war materials, it would be necessary to increase the labor force to 6.4 million persons from 1942 to 1944. This would necessitate the employment of 60% of the available non-farm housewives under 45 without small children. It would also involve employing more than 15% of the youths who would normally be in school, as well as more than 15% of the workers who would normally retire. At the same time we have assumed that we could secure 150,000 Mexican workers. We would be making as great, if not greater, demands upon our manpower as are the European belligerents."

In relation to hours worked the conclusion states in part that, "It assumes an actual work week of 48 hours for all workers, 5.4 hours more than was actually worked in the first half of 1942 and 8 hours more than the 40-hour work week. . . . In many instances, both the hours scheduled and the actual hours of work would have to be in excess of 50. . . . It assumes that the production of goods for civilian use would be reduced by one-third. Unless money wages are reduced, taxes and savings would have to be increased by about 30 billion dollars to absorb the excess income of the population. . . . If we are to build up an armed force of 9.5 million men by the end of 1943 the government must immediately make a number of significant decisions and adopt the appropriate measures: (1) it must take steps to increase the actual working week from 42.4 to an average of at least 46 hours in 1943; (2) efforts must be made to bring at least 6.4 millions of additional workers into the labor force; (3) a drastic curtailment in the output of civilian goods must be undertaken

at once; (4) the shipbuilding program must be greatly expanded."

Commenting on the part played by the several government departments, the booklet points out that, "We have said that the government must immediately make a number of significant decisions. Where does the responsibility and authority for such decisions lie? The Army and the Navy can decide how many men they need and the amount of equipment that is required; but they have no authority over the mobilization of the industrial army. The War Production Board can plan the production program and allocate materials; but it has no control over either the size of the Army or the mobilization of labor. The War Manpower Commission has nothing to say about the size of the armed forces and as yet its control over the disposition of industrial manpower is inadequate. The Maritime Commission neither determines the amount of shipping required nor controls the allocation of resources to shipbuilding. Decisions involved must be based upon a coordinated national policy designed not only to give balance within the war production program itself but balance between military manpower requirements and industrial manpower requirements."

Responsibility for these decisions obviously rests solely with the President.

## Production Ratio Report*

(Production as per cent of six-day capacity)

COMPARATIVE WEEKLY SUMMARIES

| Current Weeks—1942 | | Corresponding Weeks—1941 | |
|---|---|---|---|
| October 17 | 89.9 | October 18 | 105.5 |
| October 24 | 89.9 | October 25 | 106.4 |
| October 31 | **92.9** | November 1 | 108.6 |
| November 7 | 89.9 | November 8 | 105.0 |
| November 14 | 89.6 | November 15 | 107.0 |
| November 21...(Prelim.) | *87.5* | November 22 | 105.3 |

COMPARATIVE MONTHLY SUMMARIES

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July |
|---|---|---|---|---|---|---|---|
| 1941 | 85.6 | 89.7 | 92.2 | 96.0 | 98.7 | 99.3 | 94.2 |
| 1942 | 104.5 | 103.9 | 102.9 | 100.4 | 95.3 | 87.4 | 75.8 |

| Year | Aug. | Sept. | Oct. | Nov. | Dec. | Year Avg. |
|---|---|---|---|---|---|---|
| 1941 | 101.0 | 99.7 | 105.2 | 106.2 | 100.4 | 97.4 |
| 1942 | 80.8 | 82.9 | *90.4* | .... | .... | .... |

COMPARATIVE YEARLY SUMMARIES

| | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 |
|---|---|---|---|---|---|---|---|---|
| Year to Date.. | 69.6 | 79.7 | 83.2 | 71.3 | 82.3 | 86.1 | 96.8 | *91.8* |
| Year Average. | 69.9 | 80.4 | 79.8 | 71.5 | 83.4 | 85.6 | 97.4 | ... |

* Based on tonnage reported to American Paper and Pulp Association. Does not include mills reporting to National Paperboard Association, except in isolated cases where both paper and paperboard are produced and separate tonnage figures are not readily available. Does not include mills producing newsprint exclusively.

PAPERBOARD OPERATING RATIOS †

| Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Year Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1937 | 83 | 89 | 89 | 91 | 88 | 80 | 69 | 77 | 72 | 70 | 57 | 47 | 75 |
| 1938 | 56 | 63 | 63 | 60 | 60 | 59 | 59 | 60 | 70 | 73 | 67 | 61 | 64 |
| 1939 | 65 | 73 | 76 | 74 | 69 | 73 | 68 | 77 | 82 | 91 | 88 | 77 | 77 |
| 1940 | 78 | 75 | 74 | 76 | 82 | 85 | 77 | 79 | 78 | 85 | 82 | 77 | 78 |
| 1941 | 81 | 88 | 89 | 89 | 91 | 94 | 92 | 98 | 95 | 99 | 98 | 90 | 92 |
| 1942 | 102 | 101 | 101 | 95 | 82 | 72 | 68 | 75 | 76 | *81* | .. | .. | .. |

Week ending Oct. 17, 1942—79
Week ending Oct. 24, 1942—81
Week ending Oct. 31, 1942—84
Week ending Nov. 7, 1942—84
Week ending Nov. 14, 1942—83
Week ending Nov. 21, 1942—*83*

† Per cents of operation based on "Inch-Hours" reported to the National Paperboard Assn.

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Edited by R. G. Macdonald, Secretary

# Heat-Transfer Characteristics of an Indirectly-Heated Digester*

By J. G. L. Caulfield[1], L. C. Jenness[2] and G. L. Nyatrom[3]

## Abstract

*Over-all and film coefficients of heat transfer are presented calculated from data obtained in an indirectly-heated experimental digester. The fluids studied include water, 30% caustic, soda black-liquor, and sulphite cooking liquor. Over-all coefficients are found to vary from 161 B.t.u. per hr. per sq. ft. per deg. F. at a mass velocity of 33 lb. per sq. ft. per sec. to 550 B.t.u. per hr. per sq. ft. per deg. F. at a mass velocity of 500 lb. per sq. ft. per sec. The liquid film resistance is found to control until a mass velocity of approximately 350 lb. per sq. ft. per sec. is reached, after which control is in the steam film. For a given mass velocity, sulphite cooking liquor is found to yield the highest over-all coefficients of any of the solutions studied, which is attributed to gassing of the solution on the heating surface. The possibility that commercial heaters may be operating in the undesirable range of minimum steam film conductance is suggested.*

Data concerning the heat transfer characteristics of an experimental indirectly-heated digester have previously appeared in the literature *(1)*. Over-all coefficients of heat transfer were given for water at mass velocities of 29 pounds per square foot per second to 130 pounds per square foot per second. The values of the coefficients varied from 204 at the lowest mass velocity to 412 at the highest mass velocity, with the variation of coefficient with mass velocity expressible by the equation

$$U = mV^n$$

Only the period up to the boiling point was considered.

The purpose of the present article is to extend to higher mass velocities the data existing on water, and to present data on the heat transfer characteristics of caustic solutions, soda black liquor and sulphite cooking liquor in the same equipment.

## Apparatus and Procedure

The apparatus employed was an experimental digester of about two cubic feet capacity. The arrangement of digester, heater, pump, and accessories is shown in Fig. 1. Rate of circulation was measured by means of a rotameter in the pump discharge line. Three heaters of different internal diameters and lengths were employed so as to cover a range of mass velocities and heating-tube shapes. One heater was constructed of stainless steel, standard one-inch iron pipe size, and three feet in length. The second heater was of standard black iron, ⅜ inch diameter and 6 feet long, while the third was standard black iron, 0.5 inch diameter and 9 feet 6 inches long. All three were of single-tube, single-pass construction enclosed in an external steam jacket of standard iron pipe.

The experimental procedure consisted of taking readings at 5-minute intervals of the temperature of fluid entering the heater, at the same time holding heating-steam pressure constant and maintaining a constant rate of liquid flow.

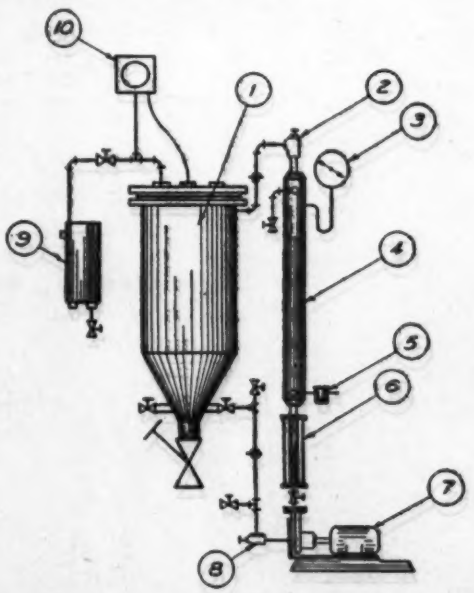


FIG. 1

Experimental Apparatus. 1. Stainless Steel Digester. 2. Thermometer Well. 3. Pressure Gage. 4. Heater. 5. Steam Trap. 6. Rotameter. 7. Centrifugal Pump. 8. Thermometer Well. 9. Relief Condenser. 10. Pressure and Temperature Recorder.

* Presented at the Annual Meeting of the Technical Association of the Pulp & Paper Industry, Hotel Commodore, New York, N. Y., Feb. 16-19, 1942.

[1] Assistant Professor of Pulp and Paper Technology, University of Maine, Orono, Me.

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[3] B.S. in Chemical Engineering, Pulp and Paper Division, 1941, University of Maine, Orono, Me.

## Discussion of Data

Experimental data are shown in Table I, together with the over-all heat transfer coefficients calculated therefrom. In computation of the coefficients the equation

$$\frac{Q}{\Theta} = UA\ \Delta t^{ave.} \qquad (1)$$

was employed, the temperature difference being the logarithmic average with respect to time from the start of the run to its completion. The use of such an average temperature difference assumes constancy of coefficient and specific heat, as well as no change of state in the fluid heated. While the two latter conditions may be complied with in a heater of the type employed, the overall coefficient would be expected to vary as fluid temperature increased. As a check on the validity of the use of the logarithmic average temperature difference a graphical method may be employed *(1)*. Equation 1 may, for constant temperature of heating steam, be restated as

$$\Theta = \frac{WC}{UA}\ 2.3 \log \frac{T-t_1}{T-t_2} \qquad (2)$$

where $T$ represents heating steam temperature, $t_1$ initial fluid temperature and $t_2$ fluid temperature entering the heater corresponding to the elapsed time $\Theta$. If $U$ is constant, then if $\Theta$ is plotted versus 2.3 log $\frac{T-t_1}{T-t_2}$ a straight line will result. When the data of Table I were so plotted, straight lines resulted in nearly all cases and in no instance was the curvature pronounced.

TABLE I.—EXPERIMENTAL DATA

| Run | Solution | Steam pressure, p.s.i. | Initial liquid temp., deg. F. | Final liquid temp., deg. F. | Over-all coefficient, B.t.u./hr./sq. ft./° F. | Mass velocity, lb./sq. ft./sec. | Linear velocity, ft./sec., ave. | Internal diam. of heating tube, in. |
|---|---|---|---|---|---|---|---|---|
| 1 | Water ..... | 35 | 75 | 232 | 204 | 29 | 0.47 | 1.049 |
| 2 | Water ..... | 40 | 109 | 236 | 284 | 53 | 0.87 | 1.049 |
| 3 | Water ..... | 42 | 50 | 238 | 340 | 88 | 1.43 | 1.049 |
| 4 | Water ..... | 40 | 84 | 219 | 335 | 88 | 1.44 | 1.049 |
| 5 | Water ..... | 41 | 55 | 221 | 364 | 113 | 1.84 | 1.049 |
| 6 | Water ..... | 40 | 84 | 229 | 416 | 130 | 2.13 | 1.049 |
| 7 | Water ..... | 42 | 60 | 220 | 350 | 234 | 3.81 | 0.493 |
| 8 | Water ..... | 42 | 52 | 224 | 396 | 278 | 4.53 | 0.493 |
| 9 | Water ..... | 40 | 64 | 229 | 413 | 293 | 4.18 | 0.493 |
| 10 | Water ..... | 40 | 56 | 230 | 400 | 316 | 5.15 | 0.493 |
| 11 | Water ..... | 40 | 85 | 228 | 448 | 368 | 6.02 | 0.493 |
| 12 | Water ..... | 40 | 60 | 230 | 458 | 382 | 6.23 | 0.493 |
| 13 | Water ..... | 36 | 122 | 231 | 503 | 394 | 6.48 | 0.493 |
| 14 | Water ..... | 36 | 68 | 226 | 508 | 462 | 7.53 | 0.493 |
| 15 | Water ..... | 35 | 62 | 241 | 550 | 500 | 8.15 | 0.493 |
| 16 | Water ..... | 30 | 115 | 217 | 269 | 91 | 1.46 | 0.622 |
| 17 | Water ..... | 30 | 87 | 212 | 320 | 166 | 2.67 | 0.622 |
| 18 | Water ..... | 30 | 71 | 216 | 362 | 245 | 4.08 | 0.622 |
| 19 | Water ..... | 30 | 113 | 222 | 402 | 316 | 5.09 | 0.622 |
| 20 | Water ..... | 30 | 68 | 209 | 415 | 379 | 6.11 | 0.622 |
| 21 | 30% NaOH.. | 35 | 138 | 240 | 161 | 33 | 0.43 | 1.049 |
| 22 | 30% NaOH.. | 35 | 139 | 239 | 194 | 47 | 0.60 | 1.049 |
| 23 | 30% NaOH.. | 35 | 129 | 242 | 249 | 66 | 0.85 | 1.049 |
| 24 | 30% NaOH.. | 35 | 78 | 237 | 254 | 86 | 1.09 | 1.049 |
| 25 | 30% NaOH.. | 35 | 138 | 230 | 315 | 114 | 1.47 | 1.049 |
| 26 | 30% NaOH.. | 35 | 105 | 226 | 317 | 156 | 2.15 | 1.049 |
| 27 | 30% NaOH.. | 35 | 87 | 222 | 324 | 270 | 3.72 | 0.493 |
| 28 | 30% NaOH.. | 35 | 119 | 222 | 378 | 330 | 4.55 | 0.493 |
| 29 | 30% NaOH.. | 35 | 72 | 233 | 490 | 458 | 6.32 | 0.493 |
| 30 | Black Liquor 17.8% solids.. | 35 | 126 | 221 | 175 | 33 | 0.52 | 1.049 |
| 31 | Black Liquor 17.8% solids.. | 35 | 96 | 220 | 226 | 53 | 0.82 | 1.049 |
| 32 | Black Liquor 17.8% solids.. | 35 | 144 | 220 | 224 | 67 | 1.06 | 1.049 |
| 33 | Black Liquor 17.8% solids.. | 35 | 126 | 217 | 247 | 78 | 1.22 | 1.049 |
| 34 | Black Liquor 17.8% solids.. | 35 | 137 | 226 | 270 | 97 | 1.53 | 1.049 |
| 35 | Black Liquor 17.8% solids.. | 35 | 80 | 218 | 302 | 156 | 2.39 | 1.049 |
| 36 | Black Liquor 17.8% solids.. | 35 | 122 | 235 | 456 | 383 | 5.70 | 0.493 |
| 37 | Black Liquor 17.8% solids.. | 35 | 135 | 234 | 480 | 416 | 6.18 | 0.493 |
| 38 | Black Liquor 17.8% solids.. | 35 | 84 | 235 | 490 | 454 | 6.76 | 0.493 |
| 39 | Sulphite cooking liquor.... | 35 | 108 | 213 | 257 | 25 | 0.41 | 1.049 |
| 40 | Sulphite cooking liquor.... | 35 | 103 | 216 | 349 | 53 | 0.86 | 1.049 |
| 41 | Sulphite cooking liquor.... | 35 | 118 | 215 | 387 | 54 | 0.88 | 1.049 |
| 42 | Sulphite cooking liquor.... | 35 | 91 | 224 | 438 | 72 | 1.17 | 1.049 |
| 43 | Sulphite cooking liquor.... | 35 | 101 | 217 | 510 | 92 | 1.50 | 1.049 |

The existence of an effectively constant heat transfer coefficient may probably be explained by two facts. First, when over-all coefficients are calculated on output the effect of increasing radiation as the heating of the fluid progresses would tend to offset the increase in the value of the coefficient due to changing fluid properties. Secondly, since the over-all coefficient comprises fluid film coefficient, metal wall conductance and steam film coefficient, it is possible for a decreased steam film coefficient to offset an increased liquid film coefficient. That this takes place in the data under consideration is rather clearly indicated. The value of the steam film coefficient is known to be a function of the degree of turbulence of the condensate forming on the steam side of the metal wall and to pass through a minimum value *(2)*. Thus the rate at which condensate is formed may cause either an increase or a decrease in steam film conductance with time. Except for a few runs with low coefficients obtained with the heater of larger diameter, the rate of condensate flow was such that the steam film coefficient decreased with time. Where this was the case time-temperature difference plots produced good straight lines indicating that the increase in liquid film conductance was being substantially offset. In the few cases where both liquid and steam film coefficients increased with time some degree of curvature was noticed in the time-temperature difference plots, but it was not thought that the increase in over-all coefficient was enough to seriously invalidate the use of the logarithmic average temperature difference.

The values of over-all coefficient in Equation 2 are based on conditions of the fluid entering the heater and the temperature driving force existing at that point at any time. Since the average effective driving force throughout the heater is always smaller than this value such over-all coefficients are smaller than the true heat-transfer coefficients for the heater itself. The following equation was derived to effect a comparison of heat transfer coefficients as calculated on fluid temperature at the entrance to the heater, and as calculated with allowance for variation in temperature difference with respect to position in the heater.

If instantaneous mixing is assumed in the digester, then

$$WCdt = UA\ \Delta t_{ave.}\ d\Theta \qquad (3)$$

and at any instant the arithmetic average temperature driving force is

$$\Delta t_{ave} = \frac{(T-t) + (T-t_3)}{2} \qquad (4)$$

in which $t_3$ is the temperature of the fluid leaving the heater at any time.

For a small increment of time

$$UA\Theta\ \Delta t = W_1\ \Theta\ C\ (t_3-t) \qquad (5)$$

in which $W_1$ is the pumping rate and from which

$$t_3 = t + \frac{UA\ \Delta t}{W_1 C} \qquad (6)$$

When this variable value of $t_3$ is substituted in Equation 4, $\Delta t_{ave.}$ can be expressed as

$$\Delta t_{ave} = \frac{T-t}{1 + \frac{UA}{2W_1C}} \qquad (7)$$

Substitution of this value for $\Delta t_{ave.}$ in Equation 3 and integration, at constant steam pressure, between limits of $t_1$ and $t_2$ corresponding to initial and final values of time, $\Theta$, yields the following relationship.

$$U = \frac{WC}{A\left(\frac{\Theta}{2.3 \log \frac{T-t_1}{T-t_2}} - \frac{W}{2W_1}\right)} \qquad (8)$$

When Equation 8 is applied to the present experimental data larger values of heat-transfer coefficient result than those calculated by Equation 2. The extent of deviation is greater for the longer heaters and the lower mass velocities which would be expected from the effective temperature driving force. For the longest heater used and the lowest mass velocity the deviation is as great as 30%, but for the bulk of the data the deviation is less than 10%.

Since moderately good agreement exists between the values calculated by Equations 2 and 8 and because those resulting from Equation 2 are more conservative, Equation 2 has been utilized to evaluate the overall coefficients presented.

These over-all coefficients are plotted *versus* mass velocity on logarithmic coordinates in Fig. 2.

The data for all solutions studied fall on straight lines, with the caustic solution and black liquor showing lower heat transfer coefficients for a given mass velocity than does water. Sulphite cooking liquor, which because of its corrosive nature could be handled in the stainless steel heater only, indicates higher over-all coefficients than does water, a possible explanation being gassing of the solution on the heating surface with the consequent introduction of turbulence in the liquid film. A probable intersection of the sulphite-acid line with the line representing water is indicated at high mass velocities. That such an intersection should take place is reasonable, since the steam film is of controlling importance at high mass velocities, and any changes produced in the liquid film coefficient will be of negligible influence on the over-all coefficient. A similar intersection for the lines representing data for caustic and black liquor

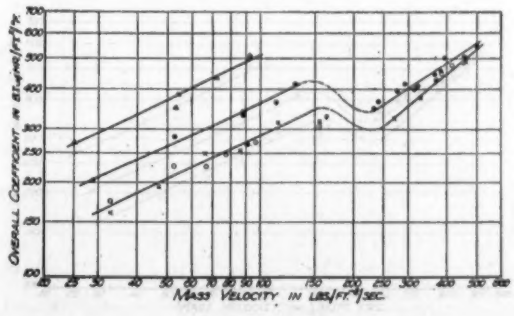


FIG. 2

Over-all Coefficient vs Mass Velocity. ● Water. O Soda Black Liquor. 17.8% Solids. × 30% Caustic. △ Sulphite Cooking Liquor

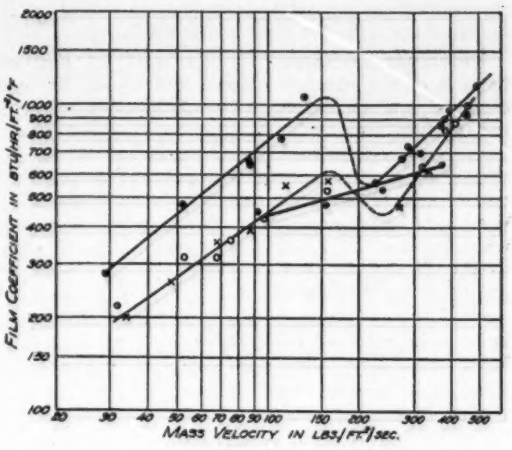


FIG. 3

Liquid Film Coefficient vs. Mass Velocity. ● Water. O Soda Black Liquor, 17.8% Solids. × 30% Caustic.

with that for water is also apparent since, with negligible resistance in the liquid film, fluid properties cease to have appreciable significance.

It will be noted that discontinuous lines are produced in Fig. 2, when a heater of smaller diameter is substituted for one of larger diameter. The discontinuity is probably due to the different values of steam film coefficient brought about by the different pipe lengths and wall thicknesses, by the increased temperature drop through the steam film at the higher values of over-all coefficient, and by the presence of a diameter term in the relationship which governs the value of the liquid film coefficient.

The experimental data of Table I, calculated to film coefficients, are shown in Tables II, III, and IV. The data for sulphite acid have not been so treated, since the range of mass velocity covered was so limited. The liquid film coefficients as tabulated, were obtained by computation of the steam film coefficient for each run *(2)*, and use of the equation

$$U = \frac{1}{\frac{1}{h} + \frac{D_1L}{D_{ave.}k} + \frac{D_1}{D_2h_2}} \qquad (9)$$

employing the value of over-all coefficient found for the run. The data of Tables II, III, and IV are

TABLE II.—FILM COEFFICIENTS CALCULATED FROM OVER-ALL COEFFICIENTS FOR WATER

| Run | Mass velocity, lb./sq. ft./sec. | Linear velocity, ft./sec. | Over-all co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Temper-ature drop in steam film, deg. F. | Steam film co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Liquid film co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Internal diameter in heating tube, in. |
|---|---|---|---|---|---|---|---|
| 1 ..... | 29 | 0.47 | 204 | 25 | 1250 | 235 | 1.049 |
| 2 ..... | 53 | 0.87 | 284 | 27 | 1220 | 340 | 1.049 |
| 3 ..... | 88 | 1.43 | 340 | 32 | 1210 | 456 | 1.049 |
| 4 ..... | 88 | 1.44 | 335 | 32 | 1210 | 445 | 1.049 |
| 5 ..... | 113 | 1.84 | 364 | 35 | 1155 | 507 | 1.049 |
| 6 ..... | 130 | 2.13 | 416 | 39 | 1120 | 622 | 1.049 |
| 7 ..... | 234 | 3.81 | 350 | 47 | 900 | 820 | 0.493 |
| 8 ..... | 278 | 4.53 | 396 | 50 | 885 | 868 | 0.493 |
| 9 ..... | 293 | 4.78 | 413 | 47 | 900 | 952 | 0.493 |
| 10 ..... | 316 | 5.15 | 400 | 49 | 885 | 893 | 0.493 |
| 11 ..... | 368 | 6.02 | 448 | 55 | 870 | 1205 | 0.493 |
| 12 ..... | 382 | 6.23 | 458 | 56 | 860 | 1280 | 0.493 |
| 13 ..... | 394 | 6.48 | 503 | 56 | 1010 | 1350 | 0.493 |
| 14 ..... | 462 | 7.53 | 508 | 56 | 1012 | 1400 | 0.493 |
| 15 ..... | 500 | 8.15 | 550 | 56 | 1010 | 1750 | 0.493 |
| 16 ..... | 91 | 1.46 | 269 | 27 | 1000 | 453 | 0.622 |
| 17 ..... | 166 | 2.67 | 320 | 32 | 1120 | 455 | 0.622 |
| 18 ..... | 245 | 4.08 | 362 | 33 | 1280 | 521 | 0.622 |
| 19 ..... | 316 | 5.09 | 402 | 32 | 1210 | 625 | 0.622 |
| 20 ..... | 379 | 6.11 | 415 | 39 | 1290 | 637 | 0.622 |

represented on logarithmic coordinates in Fig. 3 as liquid film coefficient versus mass velocity.

Reference to Tables II, III, and IV and comparison of the values of steam and liquid film coefficients shows a clear transition from liquid film control at low mass velocities to steam film control at high mass velocities. At velocities above the point where the values of the two film conductances are equal, any changes in operating conditions with a view toward increasing the over-all coefficient of heat transfer, are of decreasing consequence if applied to the fluid side of the metal wall. Promotion of dropwise rather than film condensation, or some other method for reduction of steam film resistance, would have to be resorted to to obtain an improved rate of heat transfer.[4] Very high velocities appear, therefore, to be unwarranted in heaters of the type employed here, unless desirable from the standpoint of the reduction of scale, or some similar operating consideration not directly concerned with heat transfer rate.

It has been noted before that the steam film coefficient passes through a minimum value which is dependent upon the rate of flow of condensate on the surface of the pipe wall. This rate of condensate flow is approximately 253 pounds per hour per foot of pipe periphery. With 1-inch pipe this corresponds to a rate of production of condensate of 87.1 pounds per hour, with 0.5 inch pipe the rate is 56.7 pounds per hour, and with ⅜ inch pipe, 44.7 pounds per hour. With an approximate heating surface of 0.8 square feet, and an approximate average temperature difference of 115 deg. F., which would apply to most of the data shown here, the over-all coefficient yielding the minimum steam film coefficient can be estimated by means of Equation 1. Such calculation gives an over-all coefficient of 890 B.t.u. per hr. per sq. ft. per deg. F. for one inch pipe, 580 for 0.5 inch pipe and 460 for ⅜ inch pipe. Reference to Fig. 2 shows that the mass velocity required to reach an over-all coefficient of 890 in the 1-inch heater would be in excess of 1000 pounds per square foot per second, or about fifteen feet per second linear velocity. A mass velocity of about 400 pounds per square foot per second, corresponding to a linear velocity of about 6.5 feet per second, would be required to reach a coefficient of 460 in the ⅜ inch heater.

[4] Investigations now being carried on indicate that such an improvement in steam film conductance can be accomplished without resorting to dropwise condensation.

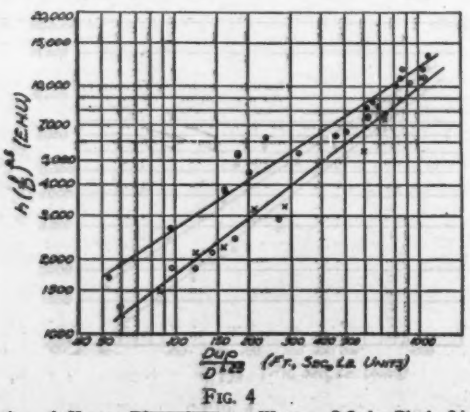


FIG. 4

Function of Heater Dimensions. ● Water. O Soda Black Liquor, 17.8% Solids. × 30% Caustic

TABLE III.—FILM COEFFICIENTS CALCULATED FROM OVER-ALL COEFFICIENTS FOR 30% NaOH

| Run | Mass velocity, lb./sq. ft./sec. | Linear velocity, ft./sec. | Over-all co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Temper-ature drop in steam film, deg. F. | Steam film co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Liquid film co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Internal diameter in heating tube, in. |
|---|---|---|---|---|---|---|---|
| 21 ..... | 33 | 0.43 | 161 | 6 | 1760 | 172 | 1.049 |
| 22 ..... | 47 | 0.60 | 194 | 9 | 1640 | 212 | 1.049 |
| 23 ..... | 66 | 0.85 | 249 | 12 | 1460 | 285 | 1.049 |
| 24 ..... | 86 | 1.09 | 254 | 18 | 1360 | 295 | 1.049 |
| 25 ..... | 114 | 1.47 | 315 | 20 | 1330 | 387 | 1.049 |
| 26 ..... | 156 | 2.15 | 317 | 24 | 1260 | 395 | 1.049 |
| 27 ..... | 270 | 3.72 | 324 | 36 | 1190 | 600 | 0.493 |
| 28 ..... | 330 | 4.55 | 378 | 42 | 900 | 787 | 0.493 |
| 29 ..... | 458 | 6.32 | 490 | 56 | 1010 | 1300 | 0.493 |

TABLE IV.—FILM COEFFICIENTS CALCULATED FROM OVER-ALL COEFFICIENTS FOR BLACK LIQUOR, 17.8% SOLIDS

| Run | Mass velocity, lb./sq. ft./sec. | Linear velocity, ft./sec. | Over-all co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Temper-ature drop in steam film, deg. F. | Steam film co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Liquid film co-efficient, B.t.u./ hr./ sq. ft./ deg. F. | Internal diameter in heating tube, in. |
|---|---|---|---|---|---|---|---|
| 30 ..... | 33 | 0.45 | 175 | 7 | 1700 | 194 | 1.049 |
| 31 ..... | 53 | 0.73 | 226 | 10 | 1500 | 262 | 1.049 |
| 32 ..... | 67 | 0.92 | 224 | 9 | 1500 | 259 | 1.049 |
| 33 ..... | 78 | 1.07 | 247 | 12 | 1450 | 293 | 1.049 |
| 34 ..... | 97 | 1.33 | 270 | 19 | 1360 | 329 | 1.049 |
| 35 ..... | 156 | 2.15 | 302 | 20 | 1350 | 379 | 1.049 |
| 36 ..... | 383 | 5.28 | 456 | 52 | 970 | 1130 | 0.493 |
| 37 ..... | 416 | 5.75 | 480 | 54 | 1000 | 1240 | 0.493 |
| 38 ..... | 454 | 6.27 | 490 | 56 | 1010 | 1310 | 0.493 |

It seems possible that heaters in commercial use may well be operating in the vicinity of minimum steam film conductance, at a time when the steam film represents the controlling resistance.

If the liquid film coefficients presented in Tables II, III, and IV are calculated by the Dittus-Boelter equation

$$h = 0.0225 \frac{k}{D} \left( \frac{D\mu\rho}{\mu} \right)^{0.8} \left( \frac{C\mu}{k} \right)^{0.4}$$

poor agreement is obtained, which is not surprising since that equation is not designed for unsteady state heat transfer where the average bulk temperature of the fluid is uncertain. The extent of deviation appears to vary both with the mass velocity and with the dimensions of the heating surface. Some investigators *(3)* have succeeded in effecting agreement with the Dittus-Boelter equation for special cases of heat transfer by altering the coefficient of the Reynolds and Prandtl groups.

It was considered that it would be more useful in the present case to correlate the data with the dimensions of the heating surface. In order to accomplish this, various functions of the product of the heater dimensions and the film coefficient were plotted on logarithmic coordinates with $\frac{D\mu\rho}{D^{1.25}}$ as abscissae. The choice of abscissa was such that if the Dittus-Boelter equation did apply to the liquid film coefficient with a constant equation coefficient dependent on the heater dimensions, a straight line should result due to constancy of the Prandtl group for any one liquid throughout the range of this investigation. It will be observed in Fig. 4 that the data for the various heaters is quite well represented by a straight line when so plotted, with the function of heater dimensions (length divided by diameter) raised to the five-tenths power. Since the slope of these lines is in the neighborhood of seven-tenths it is believed that the Dittus-Boelter equation applies to the liquid film coefficient of heat transfer with an equation coef-

ficient dependent upon the dimensions of the heater and with the conventional exponents of the dimensionless groups.

The coefficient in the Dittus-Boelter *(4)* equation could be evaluated from the lines represented in Fig. 4 for the liquids used. It is possible, however, to utilize Fig. 4 directly for the design of heating area in a multi-tube heater for the preheating of caustic solution. The rate of turnover of the digester contents will usually be fixed. If a tube of given diameter is then chosen the mass velocity, and consequently the abscissa of Fig. 4, will vary with the number of tubes selected. By varying the possible number of tubes, and reading from Fig. 4 the corresponding value of $h\left(\frac{l}{D}\right)^{0.6}$ the film coefficient, $h$, can be evaluated for that diameter since $l$ will usually be determined by the desired rate of heating of the digester contents. The value of $l$ can be arrived at by substituting various values for it in solving for the film coefficient, $h$, and then solving for the over-all coefficient from Equation 9 in which a steam film coefficient dictated by the data of Perry *(2)* would be used. The value of $l$ to be used with the selected diameter and number of tubes is then the length that provides sufficient heat transfer area to allow the desired rate of heat transfer by Equation 1 utilizing the overall coefficient determined by Equation 9. The proper number of tubes can then be selected to allow the maximum over-all coefficient for the tube diameter selected. The process may then be repeated for tubes of other diameters to determine the optimum dimensions of the heater.

## Conclusions

Over a range of mass velocities from 29 to 500 pounds per square foot per second (linear velocities from 0.47 to 8.15 feet per second), the over-all coefficient of heat transfer for all solutions studied varied logarithmically with mass velocity.

For mass velocities above approximately 350 pounds per square foot per second (linear velocity of about 5 feet per second) the controlling resistance was found to be in the steam film rather than in the liquid film.

For a given mass velocity, the highest over-all coefficients were found with sulphite cooking liquor. Thirty per cent caustic and soda black liquor containing 17.8% solids gave approximately equal coefficients for the same mass velocity and smaller than for water.

Mass velocities necessary to produce maximum steam film resistance indicate that commercial heaters may be operating in velocity ranges which result in low conductivity of the steam film, at a time when the steam film represents the controlling resistance.

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4. Dittus and Boelter, Univ. Cal. Pub. in Eng. 2:443 (1930).


## Nomenclature

$Q$ = heat quantity, B.t.u.
$\theta$ = time, hr.
$U$ = over-all coefficient of heat transfer, B.t.u./hr./sq. ft./deg. F.
$A$ = internal heating surface, sq. ft.
$\Delta t$ = average temperature difference, deg. F.
$W$ = weight of material heated, lb.
$W_1$ = pumping rate in lb./hr.
$C$ = specific heat of material
$T$ = heating steam temperature, deg. F.
$t$ = liquid temperature, deg. F.
$V$ = mass velocity, lb./sq. ft./sec.
$h$ = individual film coefficient of heat transfer, B.t.u./hr./sq. ft./deg. F.
$k$ = thermal conductivity of metal, B.t.u./hr./sq. ft./deg. F./ft.
$L$ = metal wall thickness, ft.
$D_1$ = outside diameter of pipe
$D_2$ = inside diameter of pipe
$D_{ave}$ = average diameter of pipe
$m$, $n$ = constants
$l$ = length of heater



## New TAPPI Members

The executive committee of the Technical Association of the Pulp and Paper Industry has elected the following to membership:

Harold R. Alley, technical director, Tested Papers of America, Inc., Chicago, Ill., a 1927 graduate of the University of Kansas, and formerly with the Commonwealth Edison Company, Chicago, Ill.

Kenneth A. Arnold, chemical engineer, Brown Company, Berlin, N. H., a 1942 graduate of the Institute of Paper Chemistry.

Albert G. Durgin, superintendent of research, Brompton Pulp and Paper Company, Ltd., East Angus, Que., has been reinstated as an active member.

Harold C. Friel, Mill Manager, Wood Flong Corporation, Hoosick Falls, N. Y.

Philip Goldstein, chemist, George O. Jenkins Company, Bridgewater, Mass., a 1935 graduate of Harvard University.

Fritz B. Grunwald, superintendent, Liner Board and Straw Board Mills, Consolidated Paper Company, Monroe, Mich.

John A. Kenney, technical representative The Barrett Division, Allied Chemical and Dye Corporation, 40 Rector Street, New York, N. Y., a 1915 graduate of Pennsylvania State College, and formerly with the Pennsylvania Salt Manufacturing Company, Philadelphia, Pa.

Bert C. Miller, president, Bert C. Miller, Inc., East Orange, N. J., attended Wesleyan College and formerly with the Transpara Company, Rhinelander, Wis., and S. D. Warren Company, Boston, Mass.

Charles W. Richards, chief chemist, Oxford Miami Paper Company, West Carrollton, Ohio, a 1921 graduate of the Massachusetts Institute of Technology, has been reinstated as an active member.

John E. Spalding, Assistant Manager Pilot Plant, American Viscose Corporation, Nitro, W. Va., a 1931 graduate of Massachusetts Institute of Technology, has been reinstated as an active member.

Harry J. Stilp, paper technician, Corn Products Refining Company, Argo, Ill., attended the University of Wisconsin, and was formerly with the Bryant Paper Company, Kalamazoo, Mich., the International Paper Company, Piercefield, N. Y., and in business for himself as consultant.

U. J. Westbrook, Pulp Mill Superintendent and Technical Director, Florida Pulp and Paper Company, Pensacola, Fla., a 1928 graduate of Louisiana State University, and formerly with the National Container Corp., Jacksonville, Fla.

# Some Aspects of Starch Chemistry in Relation to Tubsizing*

By Ralph W. Kerr[1]


## Abstract

*The fundamentals of starch chemistry are discussed in an attempt to explain the physical properties and chemical behavior of starch products in terms of starch composition and chemical structure. All the unmodified industrial starches appear to be composed of two types of molecules, those that are essentially linear chains of 1-4, alpha-glucosidically-linked glucopyranoses and those that are branched. The isolation of pure, crystalline, linear chains, the amyloses, and purified fractions of the branched chains, the amylopectins, are described. The distribution between the two types, about 22% linear and 78% branched, is approximately the same in corn, potato, and tapioca starches.*

*The physical properties of each type of starch component are outlined. Colloidal instability, as evidenced by the separation of an insoluble phase from dilute silution, the development of abnormal starch paste viscosities on cooling and aging, plasticity effects in pastes, and gel formation, all of which contribute to low adhesive strength and discontinuity of starch films laid down from a tub-size solution, is attributed to the presence of the linear chains.*

*Modifications of starch have been noted wherein the amount of linear chains are increased in proportion to the branched, others where the amounts of linear chains are substantially reduced. Further research is indicated along the latter lines.*

*The purpose of this paper is, primarily, to assemble and coordinate what is known of the fundamentals of starch chemistry in order to form a basis for explaining the physical properties and chemical behavior of starch products more intelligently, in terms of starch composition and chemical structure. Modifications of starch may then be evaluated for sizing purposes in general, and for the tub sizing of paper in particular.*

*Although recent years have seen notable advances in the art of tub-sizing paper with starch products, it is the opinion of many that, in order to continue developing significant achievements, a more extensive study of the fundamentals of starch chemistry is necessary.*

*To that end, the reports of other laboratories have been inspected, the literature reviewed, and some fundamental experiments have been performed by ourselves. The following is a resume of the information collected, presented in more or less chronological order.*


## Historical Backgrounds of Starch Chemistry

Pursuing an historical treatment of starch chemistry, it should be recalled that it is well over a century since the sugar, dextrose, (glucose is more correct), was recognized as the elementary building unit of starch and the disaccharide, maltose was found to be an intermediate product in the hydrolysis of starch. Therefore the essence of the problem of starch composition and structure has been: how are these building units joined together to form the component molecules which, by themselves or in aggregates, account for the physical and chemical behavior of the starches.

No historical development of starch fundamentals would be complete without mention of the work of Maquenne *(1)* who contributed no small share to the nomenclature employed in starch chemistry. Although the theory of starch heterogeneity had received considerable attention many years before Maquenne's work, at the turn of the century, this worker was probably the first to recognize that starch is chemically heterogeneous, in the sense that it is made up of two totally different types of units, and that only one component part is built exclusively of maltose residues. This fraction of starch was called *amylose*. It was appreciated that this component could exist as a completely water-soluble substance, but because of its extreme colloidal instability, it could also revert or retrograde to a completely water-insoluble form. In its soluble form it is hydrolyzed quickly and almost quantitatively to the sugar *maltose*, by enzymes such as malt diastase, whereas in its insoluble form it is unattacked. In contrast, whole starch is hydrolyzed by malt diastase to two types of products—sugars such as maltose and to dextrins which although water-soluble, resist further degradation by malt diastase.

The fraction called amylose was prepared, among other methods used, by making a hot water extraction of starch, without actually forming a starch paste. As purified, by allowing the water extract to age and the product to spontaneously precipitate from dilute solution (or retrograde, as the phenomenon was termed by Maquenne) the amylose appeared granular and devoid of gel forming properties.

Two unfortunate misconceptions were formed from the above facts: first, that when whole starch is extensively converted with the malt enzyme all of the maltose produced is derived from the one component called amylose; and second, that the other hypothetical component of starch, which is converted only as far as a soluble dextrin stage is alone responsible for the paste-forming and gel-forming properties of starch. To this latter hypothetical component, Maquenne applied the name *amylopectin*.

Most of the confusion of the next three decades can be traced directly or indirectly to various interpretations of the above concept and to the reported properties of fractions of starch, separated by procedures purporting to produce amylose and amylopectin but which actually resulted in little or no fractionation whatsoever. More frequently procedures, which were designed to produce amylopectins, we now know, actually led to a concentration of amylose and *vice versa*.

It is perhaps understandable that more modern

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carbohydrate chemists—e.g., Haworth, Hirst, and their contemporaries of the early thirties—should have either been inclined to disregard most of this early work, or that they should have sought to prove that amylose and amylopectin did not exist as chemical entities, but rather, were physical variations of the same substance. Using the fractionation techniques of that period to produce what was imagined to be amylose and amylopectin, they had little trouble in proving their point.

Unfortunately, amylose and amylopectin types of components are separated one from the other only with great skill and by the use of considerable ingenuity. Not until within the last year or two has either type been isolated in a degree of purity consistent with good practice in organic chemistry. And it is this one fact, probably more than any single other one, that has delayed so long the evolution of a clear picture for the composition and constitution of starch which would fully explain its chemical and physical behavior.

### Development of Modern Concepts of Starch Structure

Neglecting for the moment the possible heterogeneity of starch, the theory for which was discarded during the early thirties, the development of our modern concept of starch structure probably starts with the work of Haworth. Figure 1 is a review of

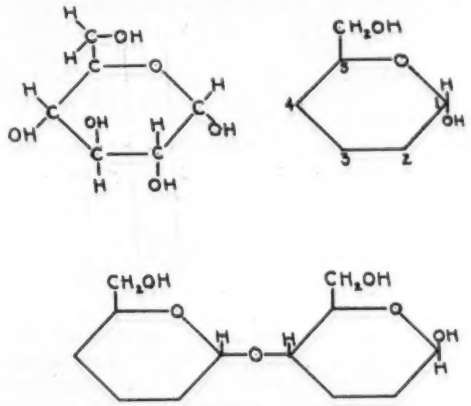

FIG. 1

**Upper Row: Configuration of Glucose, Simplified Form Given at the Right. Lower Row: Configuration of maltose.**

the Haworth configuration for glucose. The arrangement emphasizes the pyranoid ring it contains. It is often written in simplified form as given on the right. The carbons are referred to by numbers as shown, the unnumbered carbon at the top being No. 6. Below is the accepted configuration of maltose *(2)*, carbon No. 1 of one glucopyranose unit being united through an alpha-glucosidic linkage to carbon No. 4, of the other glucose molecule. Figure 2 is Haworth's configuration for starch which is simply a chain of glucopyranose units, about 25 in length, united as maltose.

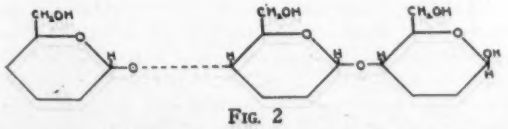

FIG. 2

**Starch According to Haworth. 1932. "A" Unit Yields 2,3,4,6 Tetramethyl Glucose. "B" Units Yield 2,3,6 Trimethyl Glucose**

This configuration for starch was arrived at as follows: in elaborating on the methylation studies of Irvine *(3)*, of a previous decade, Haworth showed *(4)* that when starch was fully methylated—i.e., all free hydroxyl groups derivatized into methyl ethers, and then the product hydrolyzed by acid, that in addition to the main product, 2,3,6-trimethyl glucose found by Irvine, a small amount (about 4%) of 2,3,4,6-tetramethyl glucose always results. From this fact he argued that in starch, the glucopyranose units are joined, one after another in chain fashion, through glucosidic linkages from carbon No. 1 of one unit to carbon No. 4 of the next; and that the terminal unit which would have a free hydroxyl group on No. 4 carbon would give rise to the tetramethyl glucose. The proportion of tetramethyl glucose found indicates that one such terminal group exists for every 24 other groups. From this, Haworth concluded that starch was composed of simple chains, about 25 glucose-pyranoses in length.

Many workers soon took up this line of study and very soon there was a veritable stampede to adopt or accept this relatively simple picture for the configuration of the starch molecule. So-called preparations of the various popular conceptions of amylose and amylopectin of that day were methylated, hydrolized and found to give identical results from which it was argued that their constitutions were identical *(5)*. Armstrong *(6)* in his well-known monograph on carbohydrates in 1934 concludes that the structure of starch has been solved. Hanes, the eminent biochemist, published in 1937 a 92-page biochemical brief for Haworth's concept *(7)*.

There were a few workers, however, who were neither satisfied with Haworth's work and conclusions nor with Hanes' explanations for certain shortcomings in the latter.

Farrow *(8)* and his coworkers pointed out that Haworth's structure, with an aldehyde group for every 25 glucose units was at variance with the experimental fact that the stoichiometric reducing power of starch requires a chain length of approximately 1000 glucose units to the molecule.

In 1937, Staudinger *(9)* reasoning from physiochemical data, principally on viscosity and osmotic pressure studies, concluded that Farrow was more nearly correct in his estimate of molecular weight. He was led to believe that the structure was not a straight chain, but was highly convoluted and proposed a configuration which would harmonize with the experimental data of all three investigators. Reference to Fig. 3 shows that we may have a branched structure of indefinite length and still maintain Haworth's ratio of terminal "A" units to intermediate units. The structure is symetrically branched, as shown, first a branch on one side through a No. 6

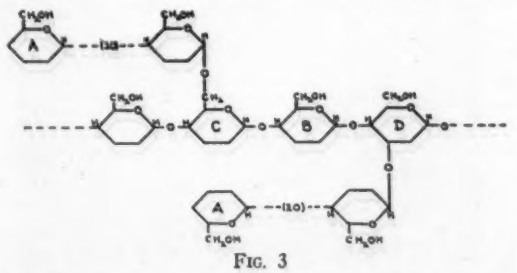

FIG. 3

**Starch According to Staudinger, 1937. "C" Units Yield 2, 3 Dimethylglucose. "D" Units Yield 2,6 Dimethylglucose**

carbon on one glucose (as in Unit C) which on methylation and hydrolysis should yield 2,3-dimethyl glucose and then alternating with a branch through a No. 3 carbon on the other side of the chain (as in Unit D) which should yield 2,6-dimethyl glucose. Staudinger admitted the chemical evidence for his proposed structure was still to be applied.

Freudenberg *(10)* became interested in the discussion and supplied the chemical evidence required by finding the correct proportions of 2,3- and 2,6-dimethyl glucose in the hydrolysis products of fully methylated starch.

Hess and Hirst and Young and other investigators took up the question of a branched chain structure for starch and finally in 1939, Haworth was won over to this theory as well *(11)*.

But in 1940 Freudenberg *(12)* came to the conclusion that the 2,6-dimethyl glucose can and does result by acid hydrolysis of the 3-methoxyl group of 2,3,6-trimethyl glucose during the hydrolysis of methylated starch. The 2,3-dimethyl isomer does not result when 2,3,6-trimethyl glucose is treated with acid under the same conditions used to hydrolyze methylated starch. The conclusion is that starch contains branched configurations but with branching only through the No. 6 carbon of various glucopyranose units.

Additional evidence exists that starch contains structures which are branched through a 1-6-alpha-glucosidic linkage. Myrbäck has recently reported isolating a trisaccharide containing this linkage in the products of a limited hydrolysis of starch. But the question as to how much 1-6 branching exists in starch or as to whether 1-6 glucosidic branching is the only complexity in the structure of starch units, should still probably be left open.

## Starch Composition

Unfortunately the above work on the configuration of the starch molecule is predicated on the theory that only one type of molecule exists in starch, which theory is now evidently contrary to the facts.

FIG. 4

Corn, Crystalline Amylose, 400×

In 1940 Meyer *(13)* called attention again to the amylose-amylopectin theory and confirmed the critical experiments of Maquenne. By elaborating on the technique of hot water extraction and spontaneous precipitation of the extract (retrogradation, according to Maquenne) a fraction of starch was obtained which converted completely to maltose. These molecules are straight chained according to the general type of formula proposed originally by Haworth for whole starch. The branch structure found by Staudinger, Freudenberg, and others for starch molecules does not apply to amylose but to the residual material not extractable by hot water. Pascu *(14)* pointed out that starch could not be homogeneous, in that cellulose fibers selectively adsorb from solution that component of a starch paste which stains blue with iodine, evidently an amylose type.

Kerr and Trubell contributed by showing *(15)* that a component could be separated from corn starch which was different from the balance of the starch in chemical and physical properties and hence it was at variance with the facts to assign one type of formula to all of starch. This product, provisionally called gamma-amylose is now recognized as being of a more linear configuration and hence an amylose type. Possibly the most significant contribution was Schoch's observation that all linear types, that is, the amyloses, are selectively precipitated (and in rather quantitative fashion) by adding butanol to dilute starch pastes *(16)*. The branched or amylopectin types remain soluble. By such a procedure, the composition of the more important industrial starches, corn, potato, and tapioca have more recently been found to be 21 to 23% straight chained and 77 to 79% branched chained components.

Quite recent contributions by Kerr and Severson *(17)* have been the isolation of amyloses in crystalline form. This was accomplished by freeing starch of its impurities, extracting with hot water, concentrating the extract under reduced pressure, and slowly crystallizing out the amyloses by the addition of butanol to the hot concentrate. After several recrystallizations, by dissolving the product in hot water, filtering, saturating with butanol, and slowly cooling, crystals of exceptional high purity are finally obtained. Pure amylopectin types are obtained either as a whole fraction by precipitating the amylose types from dilute starch pastes with butanol and removing the last traces of amylose by adsorption on cotton fibers or in subfractions by progressively increasing the butanol content of the paste. The latter is accomplished by adding a determined amount of butanol to a hot solution and then adding just sufficient methanol to solubilize the butanol. The subfractions are reprecipitated several times by dissolving in water and adding the same ratio of butanol to water used in the first precipitation.

Crystalline amyloses have been prepared from corn, potato, and tapioca starches. Figure 4 is a microphotograph (taken at a magnification of 400) of the platelet shaped crystals from corn starch. Those from potato, and more particularly from tapioca, are of less width and appear as needles.

The crystalline amylose from corn starch is substantially a linear arrangement of 1-4-alpha-glucosidic-linked glucopyranoses *(17, 18)*. Further evidence of regularity of structure is obtained by treating dilute solutions of the amylose with Macerans amylase whereby 70% yields, or higher, of Schardinger dextrins (cycloamyloses) *(19)* are obtained in contrast to 44% yields obtained from the amylopec-

tin type fractions. From their high degree of conversion into maltose with beta-amylase, it is probable that those from potato and tapioca are essentially linear also. The molecular magnitude of the latter two are substantially higher than the cornstarch crystals. It would follow, therefore, that to explain the greater colloidal instability of corn amylose one must assume that there is a length of chain which is optimum for orientation into aggregates which precipitate.

The possibility cannot be excluded at present, however, that potato and tapioca amyloses are not exactly linear but are, rather, of a V- or forked-type pattern. This study is being further pursued in our laboratories.

The amylopectin fractions are branched to such an extent that only about 52% maltose is produced from the purest fractions with beta-amylase. Both potato and tapioca amylopectins are, judged by the alkalilabile value of Schoch *(20)* as intricately branched and of the same molecular magnitude as corn amylopectins. All three possess high colloidal stability as judged by precipitability from water solutions by methanol. Potato amylopectin from unmodified starch is measurably more stable than corn or tapioca amylopectins. This may be attributed to the fact that potato amylopectin contains combined phosphoric acid, which complex at neutral pH's would tend to form soluble salts with potassium or sodium. Samec *(21)* has found, however, that this combined phosphate hydrolyzes off in the early stages of conversion to modified starch products.

Some of the salient characteristics of the crystalline amylose and the purified amylopectin fraction from corn starch are summarized in Table I. It will be seen that the tendency of a paste to retrograde must be ascribed to the presence of the linear fraction. Furthermore, most of the undesirable features which follow from retrogradation effects—gelling or abnormal viscosities, precipitation of insoluble phases—all are attributed to the presence of this same fraction.

To amplify on the information on starch pastes to be gained from Table I, it may be pointed out that low temperatures, low pH, high concentration, favor retrogradation as does the presence of fatty impurities or additives, and certain metallic ions such as calcium or barium.

High temperature, high pH (or alkalinity), low concentration, retard retrogradation.

TABLE I.—COMPARISON OF PROPERTIES OF CORN AMYLOSE WITH CORN AMYLOPECTIN

| | Straight-Chain Amylose | Branched-Chain Amylopectin |
|---|---|---|
| Solubility in Water | Originally soluble as isolated | Soluble after separation from amylose |
| Coloidal Stability | Spontaneously precipitates from solution above 0.5% concn. | Very stable in 5% solutions |
| Gel Properties | 5% solution sets quickly to tough, irreversible gels | Forms soft gels which redissolve |
| Viscosity Characteristics (dilute solutions) | Lower, but enormous increase with concn. | Higher, simple function of concentration |
| Protective Colloid Effect (clay) | Low. Negative at high concentration | High. |
| Iodine Color | Intense blue | Reddish purple |
| Enzymes | | |
| 1. Liquefying ($\alpha$ amylases) | Attacked very slowly. Retrogrades and is then resistant | Readily converted to lower dextrins |
| 2. Saccharifying ($\beta$ amylase) | Readily converted, 95-100%, to maltose at low substrate concentration. At high concentration retrogrades to resistant form | Converts 52% to maltose, 48% to soluble dextrins |
| Estimated Molecular Weights | 35,000 (200 glucose units) | 350,000 (2000 glucose units) |

## Application

Native starch is too viscous for most paper-sizing operations, tub-sizing in particular. The starch is accordingly treated to reduce its viscosity, either by the starch manufacturer or papermaker. An examination of starch modified by some of the common converting agents and procedures, discloses the following.

Acid-converted starches produce a higher yield of butanol precipitable material (as high as 35%) which is very colloidally unstable than is produced from original starch. This action of acid is explained as the production of new, short, linear chains by breaking off the branches from the complexly constituted amylopectin types.

Some types of dextrins show a marked reduction in material precipitable with butanol, other types show little change.

Alpha-amylase (the liquefying factor of malt diastase) produces an exceptionally large amount of retrograding material for possibly similar reasons. Beta-amylase (the saccharifying factor of malt) acts by breaking away two glucose units at a time in the form of maltose; alpha-amylase in contrast, acts by breaking away large fragments of the molecule at a time *(7)*.

Oxidized starches such as the hypochlorited gums of commerce give negligible yields of butanol precipitable material. The long, straight-chain amylose is either preferentially destroyed in the chlorination or else chemically modified to a permanently soluble condition *(22)*.

For sizing purposes—e.g., tub-sizing—a starch product should possess the following characteristics:

1. High solubility for a relatively high-average molecular magnitude
2. Lack of separation of insoluble or retrograding phase
3. Small increase in viscosity with decrease in temperature or increase in concentration
4. Continuity of film formed.
5. High protective colloid effect. (Especially desirable in surface coatings.)

Then it follows that to produce a more efficient size, that either:

1. The starch should, before final modification to this useable viscosity, be pretreated or fractioned to remove the more linear amylose fractions.
2. Oxidized or properly dextrinized, or treated otherwise, to permanently solubilize the unstable amylose fraction or
3. If the paper manufacturer enzyme-converts the starch to a suitable viscosity, then conditions should be established in his enzyme conversion which would preferentially favor the conversion of the amylose into low molecular weight bodies with a minimum degradation of the amylopectin molecules.

All of these methods are under study and should lead to significant advances in the art of applying starch products in paper-sizing operations in general and tub-sizing in particular.

In the future development of work of this nature, close cooperation, however, will be necessary between the starch chemist and technologists using the finished starch products.

On the basis of the work which has been done, it would seem likely that such future developments will primarily concern utilization of those fractions of starch which best lend themselves to the intended purposes, and that there will be involved, perhaps, pretreatment of starch in manufacture so as to make available to the user a produce which needs no further modification at the point of ultimate use.

## Conclusions

1. All the unmodified industrial starches investigated appear to be composed of two types of molecules, those that are essentially linear chains and those that are branched.

2. The distribution between the two types is approximately the same for corn, potato, and tapioca starches, about 22% straight chained and 78% branched.

3. Colloidal instability as evidenced by the separation from dilute solution of an insoluble phase, the development of abnormal starch paste viscosities on cooling and ageing, plasticity effects in pastes, and gel formation, all of which contribute to low adhesive strength and discontinuity of starch film laid down from tub-size solution, is attributed to the presence of the linear chains.

4. Modifications of starch have been noted wherein the amount of linear chains are increased in proportion to the branched, others where the amounts are substantially reduced. Further research is indicated along the latter lines.

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# Conservation of Metal and Rubber by Cellulose Sheetings*

By A. F. Wendler[1]

A year or so ago, the average individual gave little, if any, consideration to the possibilities of replacing metal and rubber with cellulose sheeting.

Fortunately, however, research laboratories of many organizations had been occupied in improving their products and were striving for broader uses of their materials in the fields in which they had already gained acceptance.

The various groupings such as metal can producers, paper manufacturers, and producers of transparent films appeared content not to attempt too seriously to encroach upon the territories of each other.

With the advent of critical shortages in the metal and rubber industries, it took but little persuasion to divert research, selling, and promotional activities toward these established markets.

It was soon found, however, that the accomplishment of the desired results was not an easy task, and it was necessary for closer cooperation between the various types of industries.

As an illustration of the above, it is quite illogical to believe that paper alone could serve as a general substitute for metal or rubber. Similarly, transparent films by themselves lack, in certain instances, some of the desired characteristics—particularly that of strength. By a combination of the two, however, the fulfillment of the desired requirements is much more readily possible.

This combination of opaque papers and transparent films was by no means new, but previous activities had been devoted almost without exception to the use of cellulose acetate films for lamination of papers and board for decorative or surface protective purposes. Relatively little effort was directed toward moisture-vaporproofness, resistance to water immersion, gasproofness, durability, etc.

Cellophane-regenerated cellulose film which, ever since its inception, has played an important role in the preservation of foodstuffs, lends itself admirably to these combinations largely through some of its outstanding characteristics which are:

1. High impermeability to moisture vapor and gas
2. Grease and oilproofness
3. High strength and flexibility
4. Large area factor per pound
5. Availability in a wide variety of types to fulfill the requirements of specialized users.

Cellophane when used with various products of the paper industry, such as boxboard, chipboard, glassine, parchment, etc., is, under present-day conditions, functioning to conserve appreciable tonnage of metal and rubber. At the same time, through reduction in weight and space over normal peace-time packaging, savings are being effected in shipping costs and materials, in addition to reducing railroad and cargo requirements.

In this connection, it is not claimed that all of the newer packages are in every respect equal to the present containers, but they are felt to be of sufficient merit to be used during the emergency to save more critical materials for war use. In other instances, the newer packages are proving themselves to be superior to the previous packaging.

The development and evaluation of such replacement packages is, however, not as simple a task as often is supposed. With the establishment of Government specifications of moisture-vaporproofness, leakproofness, gastightness etc. on Army, Navy and Lease-Lend shipments, testing procedures are considerably more exacting than those previously used for peace-time packaging.

Simple moisture-vapor transmission tests serve to evaluate basic films or film combinations as produced, but fail to establish the adequacy of these materials after subjection to folding, creasing, and other degradations caused by conversion operations necessary

* Presented at the Fall Meeting of the Technical Association of Paper and Pulp Industry, Hotel Statler, Boston, Mass., Sept. 29-Oct. 1, 1942.

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for completion of the final package. Similarly, conventional tests of this type fail in their adequacy in evaluating the effects of direct water contact either from without or when packaging aqueous products.

Further, it must be remembered that irrespective of the degree of perfection obtained in the basic sheet, the final package is no better than the perfection of its closures, its ability to preserve the product in its original condition at the time of packaging and the ability of the package to withstand the required handling until its final consumption.

Now let us examine the progress being made, using cellophane as a replacement for metal and rubber.

### 1. Frozen Food

In the quick-frozen food industry, a typical consumer unit is made with a "Peters" style printed, waxed cardboard carton lined with special moisture-proof cellophane spot-glued in position and carton overwrapped with waxed paper. A corresponding consumer pack for canned peas is the No. 2 can.

A comparison of the two methods of packaging one million pounds of peas bring to light the following interesting facts:

| | *Cellophane Cartons* | *Tin Cans* |
|---|---|---|
| Total Weight of Packaging .. | 132,306 lb. | 404,189 lb. |
| Total Cost ..... | $12,745.00 | $31,715.00 |
| Total Space Required ..... | 28,000 cu. ft. | 43,180 cu. ft. |
| Freight Cars Required ..... | 31 | 64 |

This shows the quick-frozen food pack to require approximately one third the weight of packaging material at one third the cost, one half the storage space and one half the number of freight cars. With such effective savings, it is regretted that lack of freezing facilities will probably prevent the more rapid expansion of this type of packaging during the present emergency.

### 2. Cheese

Processed cheese requires very effective protection or it becomes rancid, molds, and dries out. The only materials which have been found to meet the rigid requirements have been rubber hydrochloride film, metal foil, and cellophane—and the first two are now on the critical list.

The packaging of 325,000,000 pounds of processed cheese produced yearly in the United States was until fairly recently packed in 4,600,000 pounds of metal foil. A specially processed type of cellophane has now conserved a great majority of this metal foil for more critical uses.

In addition, in the 8-ounce unit, a saving of 16 pounds of packaging material per 1000 pounds of cheese has been effected in addition to a reduction in wrapping costs.

The situation on cream cheese packaging has been similar, and cellophane laminated to parchment sheets is effecting further conservation of metal foil in this application.

### 3. Frozen Eggs

Frozen eggs have normally been packed in 30-pound tin cans. Within the past few months, fiber containers with cellophane-bag liners have been adopted. These have resulted in savings in weight, 30% saving in space and at a reduced cost. The package has been approved by the Consolidated Classification Committee of Eastern, Western, and Southern Railroads.

### 4. Coffee

Prior to Government restrictions, the conventional package for this product was either a vacuum tin or a paper bag lined with a rubber hydrochloride film. At present, with both metal cans and rubber film restricted, cellophane-lined paper bags are most satisfactorily conserving further quantities of these critical materials.

### 5. Dehydrated Foods

Up to a couple of years ago dehydrated foods were a relatively unimportant factor from a national standpoint. A few large factories had built a substantial business, but their activities were confined principally to industrial and wholesale usage with the ultimate consumer seeing very little of the product except as specialties, such as dehydrated parsley leaves, onions, etc.

In 1940, however, one main division of the dehydrated food field, that of dehydrated soup mixes, began to make considerable progress. Manufacturers of this product had made considerable quality improvement and the product met public acceptance. The packaging of this product presented two major problems: one, the hygroscopic nature of the product and the other the tendency for the chicken fat used "to wick" and seep through the package. Inasmuch as metal cans were illogical on this product as they were competing with canned soup, an envelope-shaped package was adopted using a combination of metal foil and rubber hydrochloride film.

Shortly thereafter both of these materials became highly critical and manufacturers were forced to find other materials.

Experimental work showed that improved cellophane as double-wall bags or laminated to glassine provided an adequate package.

This transitional period paved the way for a much larger job to be done in connection with dehydrated foods as they enter more into the national food picture.

The Agricultural Marketing Administration is currently receiving bids for dried whole eggs, dried milk, dehydrated potatoes (both sweet and white), carrots, beets, onions, cabbage, and rutabagas. While these are primarily for Lease-Lend, the packaging problem is much the same as that of dehydrated soup, except on a larger scale.

Food processors, forced to change over from canning, will find much progress has been made in the packaging of dehydrated foods using special types of cellophane films as primary protection.

This progress has reached the point that certain manufacturers are no longer content with the reduction in volume obtained by normal dehydration and are resorting to high pressures sometimes accompanied by low temperatures to obtain further volumetric decreases of 50 to 75%.

### 6. Emergency Rations

Closely allied to the subject of dehydrated foods is that of emergency rations. Here, too, cellophane and combinations of cellophane with various types of paper and board are found to be adequate substitutes for metal and rubber.

### 7. Canned Food

In the canning industry, the use of metal cans has been considered more or less a foregone conclusion. Current restrictions are rapidly changing this picture.

Up to the present time, cellophane containers of any description are not suitable for processing foods at high temperatures after canning. On the other hand, research work has shown that by modification of canning methods it is possible, in certain cases, to effectively use cellophane and paper containers.

The leading types of containers which have been or are being developed are as follows:

(a) "Bag-in-Box" Packages

These consist simply of a cellophane bag suspended with a container which can be either a rectangular or square carton or a cylindrical container. The outer container provides the necessary supporting strength, and the cellophane bag gives the oil, leak and moistureproof qualities necessary for many products previously packaged in cans.

Probably one of the most outstanding commercial applications of this type of package is in the frozen food industry where strawberries, peaches and other frozen fruits have been packaged for some time by this method. Here the fruit and syrup are filled into the bag which has previously been spot sealed and suspended within a carton. After filling, the unit passes directly to the freezer room.

Much progress has been made in the production lines, and it is surprising to see the speed attained in the handling of these containers. The speed is, of course, by no means that of a high-speed, modern canning line, but it must be remembered that this type of packaging is still in its infancy and further improvements are bound to be developed.

Various types of bags are used within the cartons and the sizes range from very small units to large bulk units.

The principles of the "bag-in-box" package apply to a wide variety of products where cans are no longer available or desirable. Currently, market and production tests are in progress on a wide range of products covering such items as vegetable shortening, oleomargarine, jellies, preserves, sauerkraut, dried eggs, dried milk, dried powders, citrus concentrates, cake toppings, pie fillings, etc.

(b) Laminated Fiber Containers

A recent adaptation of cellophane resulting from tin and blackplate restrictions has been the fabrication of laminated fiber containers using cellophane as in integral part of the construction in both the spiral and convolute types of cans.

The use of cellophane for this purpose is not new, but the attention being given it by both fiber and metal can manufacturers will undoubtedly result in some rather startling announcements in the near future.

For this purpose, various types of cellophane both by themselves and in combination with numerous papers are being employed in a multitude of constructions in attempting to meet the individual requirements of the product to be packaged. These involve:

1. Inner linings
2. Outer coverings
3. Plies within the walls
4. Moistureproof lamination of labels.

Originally, efforts were directed principally toward the replacement of the can sidewalls, retaining the use of metal ends, thereby effecting savings of 70 to 80% of the metal.

With the tightening of metal restrictions, the present efforts are toward the complete elimination of metal. This presents a much more difficult problem involving cap-drawing operations, new methods of closures and last, but not least, the adaptation of all of these developments to a fully mechanized basis of production.

Again it is to be emphasized that these constructions are not advocated for the actual processing of the food in the cans.

At the moment, this development should be looked upon as being principally in the testing period by ourselves, the can manufacturers and the prospective user.

(c) Multiwall Bags

For bulk packaging to assist in relieving the metal drum situation, the use of multiwall kraft bags, holding 25 to 100 pounds and employing the use of cellophane laminated inner layers, appears a logical solution. Experimental domestic and export shipments of sugar and flour have shown their practicability.

### Availability of Cellophane

While certain restrictions have been placed on the use of cellophane and similar products derived from cellulose through Limitation Order L-20, it is, however, available when used to conserve other materials considered more essential to the direct war effort such as tin, rubber, etc., or when used for Government requirements or for the preservation or protection of foodstuffs and similar essential demands.

## TAPPI Notes

H. G. Burrill, formerly consulting engineer, Baltimore, Md., is now Major, Ordnance, in charge of Railroad Transportation and Utilities at Aberdeen Proving Grounds, Md.

B. W. Martin has been transferred from the Hudson Falls, N. Y., to the Savannah, Ga., mill of the Union Bag and Paper Corp.

James d'A. Clark has been appointed Major, A. S. C. Subsistance Research Laboratory, Quartermaster Depot, Chicago, Ill.

J. R. Stephenson, formerly of the American Coating Mills, is now with the U. S. Engineers in Eritrea, Africa.

W. E. Rand, formerly of the Research Institute of America, is now a chemical engineer with the Dicalite Company, 120 Wall street, New York, N. Y.

Stanley Fifield is now with the Wood Flong Company, Hoosick Falls, N. Y.

Noel R. Phillips, formerly of the R. T. Vanderbilt Company, is now with the Cowles Detergent Company, Syracuse, N. Y.

The Woodlands Section of the Canadian Pulp and Paper Association, Montreal, P. Q., has recently issued a 27-page booklet on "Efficiency in Skidding of Wood and Handling of Horses." The price is 25 cents.

## Coal Shipments on Fox River End

Appleton, Wis., November 30, 1942—Shipment of coal, pulp and other materials by boat to mills of the Fox River Valley has been suspended for the winter season. Navigation was officially closed by the United States Engineering office at Appleton, Wis., November 27. Shipping has been brisk all season in stocking up materials to avoid transportation bottlenecks this winter.

## IMPORTS OF PAPER

### NEW YORK IMPORTS

WEEK ENDING NOVEMBER 28, 1942

SUMMARY

Newsprint ..... .....324 rolls

NEWSPRINT

——, ——, ——, 324 rolls.

BONES

——, ——, ——, 724 bags.
——, ——, ——, 5978 bags.

## Announces New Color Standard

A new color standard was announced at a press conference luncheon held at the Hotel Roosevelt, New York, on November 30. The meeting was under the auspices of the American Standards Association, in cooperation with the Interchemical Company, and the General Electric Company.

The purpose of the conference was to explain and demonstrate the use of the new American War Standard, "Specification and description of color." This standard has wide practical application to all industries in which color is an important factor. It has been endorsed by the War Production Board as an aid to government purchasing. The American War Standard objective is to recognize and recommend a basic method for the specification of color and to facilitate its popular interpretation. That is, to reduce to a common understanding the results of years of technical developments in the measurement of color, so that color can be specified in terms that mean the same to all paper manufacturers and other industrial users of color.

The conference was presided over by R. E. Zimmerman, vice-president of the United States Steel Corporation and president of the American Standards Association. Speakers were Dr. Arthur C. Hardy, professor of optics at the Massachusetts Institute of Technology; Dr. Deane B. Judd, National Bureau of Standards; Dr. Lloyd Jones, Eastman Kodak Company; Lt. Col. Frank F. Steadman of the Quartermaster Depot, Philadelphia; A. Wallace Chauncey, vice-president, Interchemical Company, and E. S. Lee, director of general engineering laboratories, General Electric Company.

As the basis for the new color standard, the spectrophotometer is recognized as the basic instrument. This instrument analyzes the color in terms of the percentage of light reflected or transmitted by the color. The new standard states that "the only system of material standards that has been calibrated in terms of the basic specification is represented by the 1929 edition of the Munsell Book of Color. Thus, either of these two standards makes it possible to identify a color, or to compare two colors by telegraph by sending three numbers.

In connection with the luncheon was a color exhibit to illustrate how many industrial organizations are now using the standard. A General Electric Recording Spectrophotometer was in operation. The exhibits also showed the application of both spectrophotometry and the Munsell notation. A motion picture in color with sound was shown, which graphically illustrated the fundamentals of color analysis in layman's language.

## Paper Production Order Amended

WASHINGTON, Dec. 2, 1942—WPB has eased up the provisions of Conservation Order M-241 requiring producers of paper and paper board to restrict their output on an average monthly production basis, by action of the Director General for Operations.

Heretofore, M-241 has required that production of paper or paper board in any month be limited to the average monthly production during a base period of six months ending September 30. It was found, however, that this restriction by months imposed certain serious operating difficulties on the mills.

Under M-241 as now amended, mills are permitted to carry forward their quota from a previous month or borrow from a future month to the extent of 15% in each case.

In no event, however, may the production of any mill during any calendar quarter after January 1, 1943 exceed three times the average monthly production during the basic six-month period. As far as November and December of this are concerned production must be restricted to twice this average.

## Paperboard Men Reelect Officers

The following officers were reelected by the National Paperboard Association at its annual meeting held recently in New York:

President, Charles E. Nelson, Mac Sim Bar Paper Company, Otsego, Mich. Vice-President, George E. Dyke, president, Robert Gair Company, Inc., New York, N. Y. Executive Manager, Frederick G. Becker, 40 East 41st street, New York City, and 80 East Jackson boulevard, Chicago, Ill. Secretary and Treasurer, H. S. Adler, 80 East Jackson boulevard, Chicago, Ill.

David A. Sealey continues as secretary of the Eastern Division with office in New York City. Grafton Whiting continues as statistician and Alvin A. Newburg as assistant statistician with headquarters in Chicago.

## R. E. Stearns Elected Vice President

W. S. Stuhr, president of the United Paperboard Company, 285 Madison Avenue, New York, announces that Raymond E. Stearns has been elected vice president in charge of production.

## COMMITTEE SETS PAPER CONTRACT

*(Continued from page 9)*

No. 306. Barton, Duer & Koch Paper Co., 5.09 cents.
No. 307. Old Dominion Paper Co., 5.343 cents.
No. 308. Frank Parsons Paper Co., 5.14 cents.
No. 309. Frank Parsons Paper Co., 5.14 cents.
No. 325. Whitaker Paper Co., 5.32 cents.
No. 326. Whitaker Paper Co., 5.34 cents (1,500,000 pounds); Barton, Duer & Koch Paper Co., 5.39 cents (1,500,000 pounds).
No. 327. R. P. Andrews Paper Co., 5.36 cents.
No. 351. Resolute Paper Products Co., $7.4675 per C sheets.
No. 352. Bird & Son, Inc., $18.50 per C sheets.
No. 360. Whitaker Paper Co., 1.7964 cents.
No. 366. Mathers-Lamm Paper Co., 3.935 cents.
No. 367. R. P. Andrews Paper Co., 4.14 cents.
No. 368. Consolidated Paper Co., 4.98 cents.

# New York Paper and Pulp Market Review

## Paper Demand Continues Good in Many Major Grades — Pulp Market Less Active as Paper Mills Await Possible Curtailment — Paper Stock Market Little Changed — Scrap Bagging Prices Soft.

Office of the PAPER TRADE JOURNAL.
Wednesday, December 2, 1942.

Good demand in major grades of paper continues to appear in reports received from many manufacturers' representatives, jobbers, and general paper merchants during the current week. The stimulus of continued and steady buying in the wholesale market is attributed in considerable part to widespread anxiety of a lack of paper in the future, under the threatened curtailment of production and despite an apparent downward trend in commercial purchasing of many items and a declining per capita consumption.

The Office of Price Administration on November 28 issued an interpretation, directing that all sales made under contract by manufacturers of book and printing papers, as well as all other types of sales, are subject to the General Maximum Price Regulation. The interpretation emphasized that sales under all kinds of contracts are covered by the regulation, including those providing for interim price adjustments even though the contracts are written on an annual basis. Cost-plus or index-priced contracts, under which prices are adjusted periodically to reflect fluctuations in overall or stipulated costs, are included in the scope of the regulation and are not excepted. The regulation establishes ceilings at the levels of prices last March.

The index of general business activity for the week ended November 21, declined to 134.3%, from 135.7% for the preceding week, compared with 131.7% for the corresponding week last year. Paper board production was 4.0% lower.

Paper production for the week ended November 21 was estimated at 87.5%, compared with 105.3% for 1941, with 87.4% for 1940, with 97.3% for 1939, and with 76.2% for the corresponding week for 1938.

Paper board production for the week ended November 21 was 83.0%, compared with 96.0% for 1941, with 77.0% for 1940, with 78.0% for 1939, and with 57.0% for the corresponding week for last year.

### Wood Pulp

Activity in the pulp market is fair. Demand for bleached sulphite is reported in some quarters as well above supply, with good grades of strong unbleached more active.

Groundwood pulp is quite widely reported as scarce.

### Rags

Mill buying of new cotton cuttings is reported fair this week. Despite the influence of often repeated statements of limited supplies, prices reflect no important change. No change in the quotation on blue overall cuttings, or on other grades has been reported.

Roofing rags continue to be reported in active demand, with mills purchasing at ceiling prices.

### Old Rope and Bagging

No important change has been reported this week in the market situation of old rope. Old No. 1 Manila rope is being steadily purchased by mills at the ceiling price of $115 per ton.

Prices on scrap bagging continue to be reported soft, under very light trading. The supply situation continues tight, with little scrap available here.

### Old Waste Paper

The OPA revised schedule on waste paper which became effective on November 27, established the following prices: old corrugated, 88½; old kraft corrugated containers, 1.50; new corrugated cuttings, .90; mixed books, .85; heavy books and magazines, 1.57½; and mill wrappers, .85 per cwt.

### Twine

Commercial demand for most grades of twine is reported about normal for the season, following better than seasonal demand. Prices are firm on many grades of hard and soft fiber twines. Demand this season for the holiday trade is reported heavy.

## WPB Amends Tissue Order

WASHINGTON, D. C., Dec. 2, 1942—WPB has relaxed the provision of Limitation Order L-120 concerning the packaging of rolls of toilet paper insofar as the Army, Navy, Lend-Lease and certain other government agencies are concerned, according to the Director General for Operations.

Item (i.v.) of the Appendix to Schedule VI of the order requires that rolls of toilet paper be packed in certain minimum numbers per case, varying according to the sheet count of the roll. Since this provision is too stringent for cases which have to be shipped overseas, the Appendix to Schedule VI as amended now contains no restrictions as to cases to be delivered to the above agencies.

In addition, the Appendix to Revised Schedule I of L-120 as amended, restores size 32" by 24" to the standard size list in item (4) under the caption "Coated One Side Book Papers." This had been omitted by an error in the course of retyping.

## New England Section Meeting

The New England Section of the Technical Association of the Pulp and Paper Industry will meet on Friday, December 11, at the Roger Smith Hotel, Holyoke, Mass. The subject of the meeting will be "The Government Man Power Policy and How New England Paper Men Will Be Affected." The speakers will be Lieutenant Colonel Roy C. Charron, Reg. Field Officer, Selective Service System; and Captain R. A. B. Heap, Chief of the Labor Section Supply Board, Springfield Ordinance District.

# ELIXMAN

CAPS

Straight wound paper cores made in sizes from 2" to 10" inside diameter with any thickness wall required.

Long draw protected slot caps of heavy gauge steel in all standard sizes.

Heavy duty caps with reenforced square hole. This patented feature of reenforcement gives added strength and durability.

CORES

Samples of caps or cores will be gladly submitted

**ELIXMAN PAPER CORE COMPANY, INC.**

CORINTH, N. Y.

## MISCELLANEOUS MARKETS

Office of the PAPER TRADE JOURNAL.
Wednesday, December 2, 1942.

BLANC FIXE—Quotations on blanc fixe are firm and continue unchanged at prevailing market levels. The pulp is currently quoted at $40 per ton in barrels, at works; the powder is offered at $60 per ton, f.o.b., works. Demand reported fair for the week.

BLEACHING POWDER—Prices on bleaching powder are firm. Current demand reported active. Bleaching powder is currently quoted at $2.25 per 100 pounds, in drums, at works.

CASEIN—Quotations on casein are unchanged for the week. Standard domestic casein, 20-30 mesh, is quoted at 19 cents per pound; 80-100 mesh at 19½ cents per pound; all prices in bags, car lots. Argentine casein, 20-30 mesh, at 7½ cents per pound, c.i.f., is reported nominal. No quotations on French casein.

CAUSTIC SODA—Prices on caustic soda are reported unchanged. Supplies ample. Demand fair for the current week. Solid caustic soda is currently quoted at $2.30 per 100 pounds, flake and ground at $2.70 per 100 pounds, in drums, at works.

CHINA CLAY—Quotations on china clay are firm and continue unchanged. Demand reported fair for the current week. Domestic filler clay is currently quoted at from $7.50 to $15 per ton; coating clay is quoted at from $12 to $22 per ton, at mines. Imported clay is quoted at from $13 to $25 per long ton, ship side.

CHLORINE—Quotations on chlorine unchanged. Government demand for war use continues heavy. Chlorine is currently quoted at from $1.75 per 100 pounds, in single-unit tank cars, f.o.b., works.

ROSIN—Quotations on some grades of rosins are lower for the current week. "G" gum rosin is currently quoted at $3.43 per 100 pounds, in barrels, Savannah. "FF" wood rosin is currently quoted at $3.43 per 100 pounds, in barrels, New York. Seventy per cent gum rosin size is quoted at $3.64 per 100 pounds, f.o.b., works.

SALT CAKE—Prices on salt cake are firm. Demand reported light for the current week. Domestic salt cake is currently quoted at $15 per ton in bulk; chrome salt cake at $16 per ton. All prices in car lots, f.o.b., shipping point. Quotations on imported salt cake are nominal at $16 per ton.

SODA ASH—Quotations on soda ash are firm and continue to conform to prevailing market quotations. Demand good. Quotations on soda ash in car lots, per 100 pounds, are as follows: in bulk, $.90; in paper bags, $1.05; and in barrels, $1.35.

STARCH—Prices on corn starch continue unchanged for the current week. Pearl is currently quoted at $3.10 per 100 pounds; powdered starch at $3.20 per 100 pounds; all prices in bags, car lots, f.o.b., Chicago.

SULPHATE OF ALUMINA—Quotations on sulphate of alumina are firm. Demand reported light. The commercial grades are currently quoted at $1.15 per 100 pounds; iron free at from $1.75 to $1.85 per 100 pounds, in bags, car lots, f.o.b., works.

SULPHUR—Prices of sulphur are firm and continue to conform to prevailing market quotations. Annual contracts are currently quoted at $16 per long ton, f.o.b., mines. Spot and nearby car lots are quoted at $18 per ton.

TALC—Quotations on talc are firm and continue unchanged at prevailing market prices. Domestic talc is currently quoted at from $16 to $21 per ton, at mills. No quotations on imported talc.

## MARKET QUOTATIONS

All market quotations, excepting those otherwise designated as official OPA maximum prices, are based on the manufacturers' price level as of October 1-15, 1941; maximum wholesale prices are based on the merchants' maximum prices for stipulated quantities at a quoted price to all customers of a like class, as shown by the merchant's sales records of goods delivered during March, 1942. A merchant's price list in effect in March 1942, showing quotations of actual shipments, will establish the current maximum prices.

### Paper

(Delivered New York)

| | | | |
|---|---|---|---|
| News, per ton— | | | |
| Roll, contract | $50.00 | @ | — |
| Sheets | 58.00 | " | — |
| Kraft—per cwt.—Carload Quantities Zone A, f.o.b. Mill | | | |
| Superstandard Wrapping | $5.00 | @ | — |
| No. 1 Wrapping | 4.75 | " | — |
| Standard Wrapping | 4.50 | " | — |
| Standard Bag | 4.125 | " | — |
| Tissues—Per Ream—Carlots | | | |
| White No. 1 | 1.12½ | " | — |
| White No. 1 M. G. | 1.05 | " | — |
| White No. 1½ | 1.00 | " | — |
| White No. 2 | 1.00 | " | — |
| Anti-Tarnish M. G. | .95 | " | — |
| Colored | — | " | — |
| Kraft | .95 | " | — |
| Manila | .90 | " | — |
| Unbl. Toilet, 1 M. | 4.16 | " | — |
| Bleached Toilet | 5.70 | " | — |
| Paper Towels, Per Case— | | | |
| Unbleached, Jr. | 2.35 | " | — |
| Bleached, Jr. | 2.65 | " | — |
| Manila—per cwt.—C. l. f. a. | | | |
| No. 1 Jute | 11.25 | @ | — |
| No. 1 Manila Wrapping, 35 lb. | 5.50 | " | 5.75 |
| No. 2 Manila Wrapping, 35 lb. | 5.25 | " | 5.50 |
| Boards, per ton— | | | |
| News | *48.00 | @ | — |
| Chip | *45.00 | " | — |
| Srl. Mla. Ll. Chip | *60.00 | " | — |
| White Pat. Coated | *75.00 | " | — |
| Kraft Liners 50 lb. | *60.00 | " | — |
| Binders Boards | 84.00 | " | 116.00 |

* OPA Base Prices per 10 tons. Less than 10 tons but over 3 tons, add $2.50; three tons or less, add $5; regular 35-39 basis, add $5.; basis 40-49, add $2.50; basis 91-100, add $2.50; basis 101-120, add $5.

The following are representative of distributors' resale prices:

Rag Content Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

| | Bonds | | Ledgers |
|---|---|---|---|
| 100% Rag Ext. No. 1 | $40.25 @ $47.25 | | $41.40 @ $48.50 |
| 100% Rag | 32.20 " 37.75 | | 33.35 " 39.25 |
| 85% Rag | .... " .... | | 32.20 " 37.75 |
| 75% Rag | 24.75 " 29.00 | | 25.90 " 30.50 |
| 65% Rag | .... " .... | | 22.80 " 27.75 |
| 50% Rag | 18.70 " 22.75 | | 19.90 " 24.25 |
| 25% Rag | 16.40 " 20.00 | | 17.55 " 21.50 |

Colors at $1.00 cwt. extra.

Sulphite Bonds and Ledgers—White, Assorted Items, Delivered in Zone 1:

| | Bonds | | Ledgers |
|---|---|---|---|
| No. 1 | $10.55 @ $12.75 | | $11.70 @ $14.25 |
| No. 2 | 9.65 " 11.75 | | 10.80 " 13.25 |
| No. 3 | 9.20 " 11.25 | | 10.35 " 12.50 |
| No. 4 | 8.90 " 10.75 | | 10.05 " 12.25 |

Colors $1.00 cwt. extra.

Free Sheet Book Papers—White, Cased Paper. Delivered in Zone 1:

| | | | |
|---|---|---|---|
| No. 1 Glossy Coated | $13.65 | @ | $11.9 |
| No. 2 Glossy Coated | 12.40 | " | 14.00 |
| No. 3 Glossy Coated | 11.60 | " | 13.2 |
| No. 4 Glossy Coated | 11.15 | " | 12.7 |
| No. 1 Antique (watermarked) | 10.25 | " | 11.7 |
| No. 2 Offset | 9.60 | " | 11.00 |
| A Grade E. F. | 9.35 | " | 10.7 |
| A Grade S. & S. C. | 9.60 | " | 11.00 |
| B Grade E. F. | 8.85 | " | 10.2 |
| B Grade S. & S. C. | 9.10 | " | 10.5 |
| C Grade E. F. | 8.55 | " | 9.7 |
| C Grade S. & S. C. | 8.80 | " | 10.00 |
| D Grade E. F. | 8.25 | " | 9.5 |
| D Grade S. & S. C. | 8.50 | " | 9.7 |

Ivory & India at $.50 cwt. extra.

### Wood Pulp

OPA Maximum Prices and Canadian Manufacturers Prices, Less Freight to Destination.

| | |
|---|---|
| Bl. Softwood Sulphite | $76.00 |
| Unbl. Softwood Sulphite | 64.00 @ 66.00 |
| Bl. Hardwood Sulphite | 73.00 |
| Unbl. Hardwood Sulphite | 61.50 |
| Bl. Mitscherlich | 81.00 |
| Unbl. Mitscherlich | 72.00 |
| N. Bleached Sulphate | 86.00 |
| S. Bleached Sulphate | 79.00 |
| N. Semi-Bleached Sulphate | 82.00 |
| S. Semi-Bleached Sulphate | 75.00 |
| N. Unbl. Sulphate | 77.00 |
| S. Unbl. Sulphate | 61.50 |
| Bl. Soda | 66.00 |
| Unbl. Soda | 62.00 |
| Groundwood | 46.00 |

Transportation Allowances Applying to Producers of Wet Wood Pulp.

| | Below 50% Air Dry Weight |
|---|---|
| Northeast | $13.50 |
| Lake Central | 13.50 |
| Southern | 16.00 |
| West Coast (in area) | 10.50 |
| West Coast (out area) | 16.50 |
| | 50%-80% Air Dry Weight |
| Northeast | $11.50 |
| Lake Central | 11.50 |
| Southern | 14.00 |
| West Coast (in area) | 9.50 |
| West Coast (out area) | 15.50 |

Applying to Producers of Dry Wood Pulp.

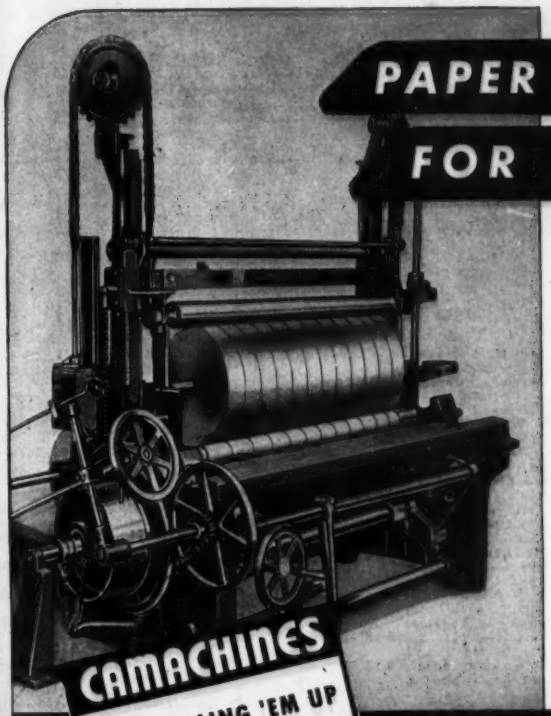
| | Above 80% Air Dry Weight |
|---|---|
| Northeast | $8.50 |
| Lake Central | 8.50 |
| Southern | 11.00 |
| West Coast (in area) | 7.50 |
| West Coast (out area) | 13.50 |

Should freight charges actually exceed these allowances, the difference may be added to the maximum price.

### Domestic Rags

New Rags (Prices to Mill f. o. b. N. Y.)

| | | | |
|---|---|---|---|
| Shirt Cuttings— | | | |
| New White, No. 1 | 8.00 | @ | 8.25 |
| Silesias No. 1 | 4.50 | " | 4.75 |
| New Unbleached | 8.00 | " | 8.25 |
| Blue Overall | 5.75 | " | 6.00 |
| Fancy | 3.00 | " | 3.25 |
| Washables | 2.50 | " | 2.75 |
| Mixed Khaki Cuttings | 2.50 | " | 2.75 |
| O. D. Khaki Cuttings | 3.00 | " | 3.15 |



# PAPER AND BOARD ROLLS FOR AMMUNITION...

**CAMACHINES** play an important role in keeping our armed forces supplied with a tremendous flow of ammunition. Tons and tons of chipboard, wad paper, partition paper, and overlay stock are used in the manufacture of ammunition.

The machines which are used to process these papers must be supplied with rolls cut to the proper width and uniformly wound for easy handling. The processing machines are fast and they are running at top speed. It takes a fast slitter and roll winder to keep ahead of the pace. That is why we recommend CAMACHINE 10-6, which runs up to 1500 F.P.M. on paper or 650 F.P.M. on board. The slitters on CAMACHINE 10-6 can be spaced to widths from ½" up. Rolls can be rewound in diameters up to 30". Write for illustrated folder.

CAMACHINES
KEEP ROLLING 'EM UP FOR VICTORY ★

CAMERON MACHINE COMPANY 61 POPLAR ST. BROOKLYN, N.Y.

MIDWEST OFFICE: Harris Trust Building, 111 West Monroe Street, Chicago

The Sorg Paper Co., Middletown, Ohio, uses this 37-foot Kalamazoo Glazed Tile Chest adapted for the Shartle Bros. "Agi-Flow."

# KALAMAZOO TILE CHESTS

Low storage cost, smooth walls inside and out for quick cleaning, and carefully designed adaptation to pump delivery and agitation for stock storage and bleaching — those are the advantages that make Kalamazoo Glazed Tile Chests a good business investment.

Any Kalamazoo Chest can be built to your individual requirements, and delivered promptly. Send for complete information.

**Pioneers of Kalamazoo Vitrified Glazed Tile**

GLAZED TILE

KALAMAZOO TANK & SILO CO.
KALAMAZOO, MICHIGAN

WOOD

### Old Rags

White, No. 1—
Repacked ..... *3.80 "
Miscellaneous ..... *3.20 "

White, No. 2—
Repacked ..... *2.90 "
Miscellaneous ..... *2.65 "

Third and Blues—
Repacked ..... *2.20 "
Miscellaneous ..... *1.80 "

Roofing Rags—
No. 1 ..... *1.55 "
No. 2 ..... *1.45 "
No. 3 (bagging) ... *1.35 "
No. 4 ..... *1.35 "
No. 5A ..... *1.35 "
Old Manila Rope .. 3.75 "
OPA Maximum Prices.

### Foreign Rags

All prices nominal

New Rags

New Dark Cuttings .. 2.25 @ 2.40
New Mixed Cuttings . 2.00 " 2.20
New Light Silesias .. 5.50 " 5.75
Light Flannelettes ... 5.50 " 5.75
New White Cuttings . 7.00 " 7.50
New Light Oxfords . 4.00 " 4.50
New Light Prints ... 3.00 " 3.25

Old Rags

No. 1 White Linens . 7.50 " 8.50
No. 2 White Linens . 6.50 " 7.50
No. 3 White Linens . 4.50 " —
No. 4 White Linens . 2.25 " 3.25
No. 1 White Cotton . 4.25 " 4.75
No. 2 White Cotton . 3.25 " 3.75
No. 3 White Cotton . 2.50 " 3.00
No. 4 White Cotton . 1.90 " 2.20
Extra Light Prints ... 2.00 " 2.40
Ord. Light Prints ... 1.75 " 2.15
Med. Light Prints .... 1.55 " 1.95
Dutch Blue Cottons . 2.25 " 2.50
French Blue Linens . 3.00 " —
Checks and Blues ... 2.00 " —
Linsey Garments .... 1.90 " 2.00
Dark Cottons ..... 1.50 " 1.60
Old Shopperies ..... 1.30 " 1.45
New Shopperies ..... 1.45 " 1.50
French Blues ..... 2.25 " 2.50

### BAGGING

(Prices to Mill, f. o. b. N. Y.)

Gunny No. 1—
Foreign ..... Nominal
Domestic ..... 4.00 @ 4.25
Wool Tares, light .... 4.25 " 4.50
Wool Tares heavy .. 4.50 " 4.75
Bright Bagging ..... 4.50 " 4.85
Manila Rope—
Foreign ..... — " —
Domestic ..... *5.75 " —
Jute Threads ..... 4.25 " 4.75
Sisal Strings ..... 3.25 " 3.75
Mixed Strings .... 1.10 " 1.20
* OPA Maximum Price.

### Old Waste Papers

(F. o. b. New York)
OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut ..... 3.37½ @ —
No. 1 Hard White Envelope Cuts .... 3.12½ " —
No. 1 Hard White Shavings, unruled . 2.87½ " —
No. 1 Hard White Shavings, ruled ... 2.50 " —
Soft White Shavings, one cut ..... 2.87½ " —
No. 1 Soft White Shavings ..... 2.50 " —
Soft White Shavings, Misc. ..... 2.15 " —
No. 1 Fly Leaf Shavings ..... 1.67½ " —
No. 2 Fly Leaf Shavings ..... 1.12½ " —
No. 1 Groundwood Fly Leaf Shavings 1.25 " —
No. 2 Mixed Groundwood Fly Leaf Shavings ..... .90 " —
Mixed Colored Shavings ..... .75 " —
Mixed Groundwood Colored Shavings .. .90 " —
Overissue Magazines ..... 1.67½ " —
No. 1 Heavy Books & Magazines ..... 1.57½ " —
Mixed Books ..... .85 " —
No. 1 White Ledger 2.17½ " —
No. 2 Mixed Ledger, colored ..... 1.87½ " —
New Manila Envelope Cuttings, one cut .. 2.87½ " —
New Manila Envelope Cuttings ..... 2.65 " —
Extra Manilas ..... 1.85 " —
Mixed Kraft, Env. & Bag Cuttings ..... 2.75 " —
Kraft Envelope Cuttings ..... 3.25 " —
Triple Sorted, No. 1 Brown Soft Kraft. 2.50 " —
New 100% Kraft Corrugated Cuttings .. 2.35 " —
No. 1 Assorted Old Kraft ..... 1.75 " —
New Jute Corrugated Cuttings ..... .90 " —
Old Kraft Corrugated Containers ..... 1.50 " —
Box Board Cuttings . .72½ " —
White Blank News .. 1.65 " —
Overissue News ..... .85 " —
No. 1 News ..... .75 " —
No. 1 Mixed Paper . .70 " —
Old Corrugated Containers ..... .82½ " —
Mill Wrappers ..... .85 " —

### Twines

(F. o. b. Mill)

(Soft Fiber)

Coarse Polished—
India ..... .21 @ —
White Hemp ..... .21 " —
Fine Polished—
Fine India ..... .26 " —
Unpolished—
Box ..... .17½ " —
Paper Makers ..... .17 " —
Tube Rope ..... .19 " —
Wall Paper ..... .20½ " —
Wrapping ..... .23 " —
Soft Fiber Rope ... .19 " —
Cotton ..... .25 " —

(Hard Fiber)

Medium Java ..... .18 " —
Mex. Sisal ..... .16 " —
Manila ..... — " —

## PHILADELPHIA

### Domestic Rags (New)

(Price to Mill, f. o. b. Phila.)

Shirt Cuttings—
New White No. 1 . .07½ @ .07½
New White No. 2 . .04½ " .05
Light Silesias ..... .04½ " .04¾
Silesias, No. 1 .... .04 " .04¼
Black Silesias, soft .03½ " .04
New Unbleached .. .07¼ " .07½
Washable Prints ... .03¾ " .03½
Washable No. 1 .. .02 " .02¼
Blue Overall ..... .04½ " .05½
Cottons—According to grades—
Washable shredding — " .01¼
Fancy Percales .... .03¼ " .03½
New Black Soft ... .02¾ " .03
New Dark Seconds 1.75 " 2.00
Khaki Cuttings—
No. 1 O. D. ..... .03 " .03¼
No. 2 Mixed ..... .02¼ " .02½
Corduroy ..... .01¾ " .02¼
New Canvas ..... .04¾ " .05¼
New Black Mixed. — " .02½

### Domestic Rags (Old)

White No. 1—Repacked ..... 3.80 " —
White No. 2—Repacked ..... 2.90 " —
Miscellaneous No. 1. 3.20 " —
Miscellaneous No. 2. 2.65 " —
Thirds and Blues—
Miscellaneous .... 1.80 " —
Repacked ..... 2.20 " —
Black Stockings—
(Export) ..... Nominal
Roofing Stock—
Foreign No. 1 ..... Nominal
Domestic No. 1 ... 1.55 " —
Domestic No. 2 ... 1.45 " —
Roofing Bagging .. 1.35 " —
Old Manila Rope ... 5.75 " —

### Bagging

(F. o. b. Phila.)

Gunny No. 1—
Foreign ..... Nominal
Domestic ..... 3.00 " 3.50
Sisal Rope ..... 3.75 " —
Mixed Rope ..... .75 " 1.00
Scrap—
No. 1 ..... 3.25 " 3.50
No. 2 ..... 1.75 " 1.80
Wool Tares, heavy ... 4.00 " 4.25
No. 1 New Light Burlap ..... 3.00 " 4.00
New Burlap Cuttings 3.75 " 4.00

### Old Papers

(F. o. b. Phila.)
OPA Maximum Prices

No. 1 Hard White Envelope Cuts, one cut ..... 3.37½ " —
No. 1 Hard White Shavings, unruled .. 2.50 " —
Soft White Shavings, one cut ..... 2.87½ " —
White Blank News .. 1.65 " —
Soft White Shavings, Misc. ..... 2.15 " —
No. 1 White Ledger. 2.17½ " —
No. 2 Ledger, colored 1.87½ " —
No. 1 Heavy Books & Magazines ..... 1.57 " —
Overissue Magazines 1.67½ " —
New Manila Envelope Cuttings ..... 2.65 " —
No. 1 Assorted Old Kraft ..... 1.75 " —
No. 1 Mixed Paper. .70 " —
Box Board Cuttings. .72½ " —
Jute Corrugated Cuttings ..... .90 " —
Overissue News ..... .85 " —
No. 1 News ..... 1.00 " —

## BOSTON

### Old Papers

(F. o. b. Boston)
OPA Maximum Prices

No. 1 Hard White Shavings, unruled. 2.87½ @ —
No. 1 Hard White Shavings, ruled ... 2.50 " —
Soft White Shavings, Misc. ..... 2.15 " —
No. 1 Fly Leaf Shavings ..... 1.67½ " —
No. 2 Fly Leaf Shavings ..... 1.12½ " —
No. 1 Groundwood Fly Leaf Shavings 1.25 " —
No. 2 Groundwood Fly Leaf Shavings .90 " —
Mixed Colored Shavings ..... .75 " —
New Manila Envelope Cuts, one cut ..... 2.87½ " —
Hard White Envelope Cuts, one cut ..... 3.37½ " —
Triple Sorted No. 1 Brown Soft Kraft. 2.50 " —
Mixed Kraft Env. & Bag Cuttings ..... 2.75 " —
Kraft Envelope Cuttings ..... 3.25 " —
No. 1 Heavy Books & Magazines ..... 1.57 " —
New Manila Envelope Cuts, one cut ..... 2.87½ " —
New Manila Envelope Cuttings ..... 2.65 " —
White Blank News .. 1.65 " —
No. 1 Assorted Old Kraft ..... 1.75 " —
No. 1 Mixed Paper. .70 " —
Overissue News ..... .85 " —
Box Board Cuttings. .72½ " —
New Corrugated Cuttings, Kraft ..... 2.25 " —
Old Corrugated Containers ..... 1.00 " —
Jute Corrugated Cuttings ..... 1.07½ " —

### Bagging

(F. o. b. Boston)

Gunny Bagging—
Foreign ..... (nominal)
Domestic ..... 3.50 @ 4.00
Sisal Rope ..... 4.50 " 4.75
Mixed Rope ..... 1.35 " 1.50
Transmission Rope—
Foreign ..... (nominal)
Domestic ..... 3.00 " 3.50
Manila Rope—
Foreign ..... (nominal)
Domestic ..... 5.75 " —
Soft Jute Rope ..... 4.75 " 5.25
Jute Carpet Threads. 3.25 " 3.50
Bleachery Burlap .... 8.50 " 9.00
Scrap Burlap—
Foreign ..... (nominal)
Domestic ..... 3.50 " 3.75
Scrap Sisal ..... 4.50 " 4.75
Scrap Sisal for Shredding ..... — " .04¾
Wool Tares—
Foreign ..... (nominal)
Soft White Shavings, Misc. ..... 2.15 " —
No. 1 White Ledger. 2.17½ " —
No. 2 Ledger, colored 1.87½ " —
No. 1 Heavy Books & Magazines ..... 1.57 " —
Overissue Magazines 1.67½ " —
New Manila Envelope Cuttings ..... 2.65 " —
No. 1 Assorted Old Kraft ..... 1.75 " —
No. 1 Mixed Paper. .70 " —
Box Board Cuttings. .72½ " —
Jute Corrugated Cuttings ..... .90 " —
Overissue News ..... .85 " —
No. 1 News ..... 1.00 " —
Domestic ..... 5.00 " 5.75
Aust. Wool Pouches. 5.10 " 5.25
New Burlap Cuttings 5.00 " 5.25
Heavy Baling Bagging 4.25 " 4.75
Paper Mill Bagging .. 2.75 " 3.00
No. 2 Bagging ..... 1.35 "
* OPA Maximum Price

### Domestic Rags (New)

(F. o. b. Boston)

Shirt Cuttings—
New Light Prints . .04½ @ .04½
Fancy Percales .... .04¼ " .05
New White No. 1. .06¼ " .06½
New Light Flannelettes ..... .05½ " .06
Canton Flannels, Bleached ..... .06 " .06½
Underwear Cutters, Bleached ..... .06 " .06½
Underwear Cutters, Unbleached ..... .05¾ " .06
Silesias No. 1 ..... .06 " .06¼
New Black Silesias .. .03 " .03½
Red Cotton Cuttings .03½ " .04
Soft Unbleached .... .06½ " .06¾
Blue Cheviots ..... .05½ " .06
Fancy ..... .02¾ " —
Washable ..... .02¾ " —
Khaki Cuttings ..... .02¾ " .03
O. D. Khaki ..... .03½ " .03¾
Corduroy ..... .03¼ " .03½
New Canvas ..... .06¼ " .06¾
B. V. D. Cuttings ... .06¼ " .06¾

### Domestic Rags (Old)

(F. o. b. Boston)

White No. 1—Repacked ..... 3.80 @ —
Miscellaneous .... 3.20 " —
White No. 2—Miscellaneous .... 2.65 " —
Twos and Blues, Repacked ..... 2.20 " —
Old Blue Overalls ... 2.25 " 2.30
Thirds and Blues, Repacked ..... 2.20 " —
Miscellaneous ..... 1.80 " —
Black Stockings ..... 3.50 " 4.00
Roofing Stock—
No. 1 ..... 1.55 " —
No. 2 ..... 1.45 " —
No. 3 ..... 1.35 " —
No. 4 ..... 1.35 " —
No. 5, Quality A .. 1.35 " —
Quality B .. 1.20 " —
Quality C .. .95 " —
* Old Manila Rope .. 5.75 " —
* OPA Maximum Prices.

### Foreign Rags

(F. o. b. Boston)

Canvas ..... (nominal)
Dark Cottons ..... (nominal)
Dutch Blues ..... (nominal)
New Checks and Blues (nominal)
Old Fustians ..... (nominal)
Old Linsey Garments. (nominal)
New Silesias ..... (nominal)

## CHICAGO

### Waste Paper

(F. o. b. Chicago)
OPA Maximum Prices

Shavings—
No. 1 Hard White Envelope Cuts, one cut ..... 3.37½ " —
No. 1 Hard White Shavings, unruled. 2.50 " —
No. 1 Soft White Shavings ..... 2.50 " —
No. 1 White Ledger 2.17½ " —
No. 1 Heavy Books & Magazines ..... 1.57 " —
White Blank News .. 1.65 " —
Mixed Kraft Env. & Bag Cuttings .. 2.75 " —
No. 1 Assorted Old Kraft ..... 1.75 " —
Overissue News ..... .85 " —
No. 1 News ..... .75 " —
No. 1 Mixed Paper .. .70 " —
No. 1 Roofing Rags .. 1.55 " —
No. 1 Roofing Bags .. 1.45 " —